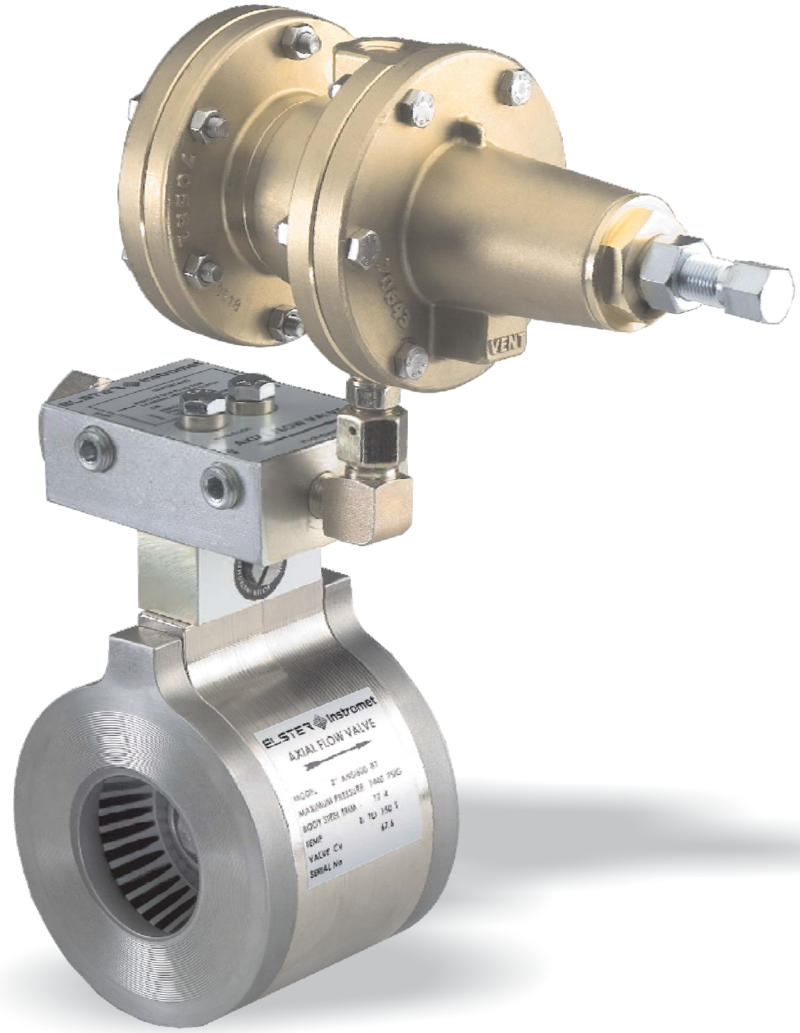
IMP 9710.4

300 and 600 Series - 2 inch thru 12 inch

Axial flow valves

Operation, Control Mainifold, Capacity Limiter, Control Loops
Installation & Repair Parts



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WARNING

THE STANDARD BUNA N SLEEVE (AMERICAN METER CODES B5, B5-L AND B7) CONTAINS NO HAZARDOUS INGREDIENTS THAT WOULD BE CONSIDERED HARMFUL TO A PERSON HANDLING THE SLEEVE.

HOWEVER, IT HAS BEEN DETERMINED THAT THE SURFACE OF THE OPTIONAL HYDRIN SLEEVE (AMERICAN METER CODES H5, H5-L AND H7) CONTAINS TRACES OF LEAD AND DIOCTYL PHTHALATE. LEAD IS KNOWN TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

RUBBER GLOVES AND AN APRON SHOULD BE WORN AND YOU SHOULD REFRAIN FROM EATING, DRINKING AND SMOKING WHILE HANDLING HYDRIN SLEEVES.

AFTER HANDLING THE HYDRIN SLEEVES, THE RUBBER GLOVES SHOULD BE DISPOSED OF AND YOU SHOULD WASH YOUR HANDS THOROUGHLY TO SAFEGUARD AGAINST THE INGESTION OF THE ABOVE MENTIONED CHEMICALS. THE APRON SHOULD BE LAUNDERED OR DISPOSED OF MONTHLY (OR MORE FREQUENTLY, DEPENDING ON USE).

ADDITIONAL INFORMATION IS AVAILABLE THROUGH AMERICAN METER COMPANY IN MATERIAL SAFETY DATA SHEETS WHICH ARE CONCERNED WITH ONLY TWO OF THE MANY HYDRIN SLEEVE INGREDIENTS: CHEM-MASTER R-81 (CONTAINS LEAD) AND DIOCTYL PHTHALATE, AS PRODUCED BY THE CHEMICAL SUPPLIER, BEFORE THE HYDRIN SLEEVE IS MOLDED. AMERICAN METER COMPANY IS REQUIRED TO TRANSMIT THESE SHEETS TO OUR CUSTOMERS BY THE OSHA HAZARD COMMUNICATION STANDARD.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA AVAILABLE TO US AND IS BELIEVED TO BE CORRECT. HOWEVER, AMERICAN METER COMPANY MAKES NO WARRANTY REGARDING THE ACCURACY OF THIS DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF. AMERICAN METER COMPANY ASSUMES NO RESPONSIBILITY FOR THE INJURY FROM THE USE OF THIS PRODUCT.

The Axial Flow Valve consists of three major structural components and a single moving part. It's unique, wafer design makes it unusually compact, light weight and easy to handle. ***(Figure 1)***

1. **Interchangeable Valve Cage Closures**
   Each consists of a center barrier, the cage with radial slots, and the closure with communicating passages. The cage closures are investment cast 17-4 stainless steel.
2. **The Valve Body**
   The axial flow valve steel body is an inside contoured, cylindrical pressure containing housing. A control gallery manifold is welded to the outside of the body.
3. **The Expansible Sleeve**
   The standard sleeve, the single moving part, is molded from Buna N, known for its resistance to various fuels and oils and for its retention of physical properties over a wide temperature range. The sleeve functions are:
   1. To provide throttling action in response to pressure differential changes.
   2. To form the closing seal over the cage barrier.
   3. To provide a closing preload against cages.
   4. To separate the control chamber from the flowing medium.
   5. To provide a contaminant seal between the valve body and the cage closures.

The Buna N sleeve is sufficiently elastic for a wide range of applications and strong enough for high pressure operation. The 70 durometer sleeve has therefore been selected as standard. The code number for the 70 durometer standard sleeve is B-7.

The 50 durometer sleeve, though more elastic, is not as rugged, as the 70 durometer sleeve and limited to lower pressure applications. The code number for 50 durometer is B-5.

Other sleeve materials are available for special applications - *(See pages 21 and 22)*.

A single bolt secures the valve assembly while the center barrier seal is completed by the O-ring seal under the fairing nut. The upstream and downstream cage pressure passages are sealed by roll pin O-rings against the body gallery. The roll pins align the cage closures and the valve body with respect to one another.

Trim

Valve trim includes all components which come into contact with the flowing fluid and are constructed from the following materials.

Buna N: O-rings
Buna N (or as specified): Sleeve
Stainless Steel: Cage closures, bolts, washer, fairing nut and roll pins

Bi-Directional Flow Capability

The symmetry of the Axial Flow Valve permits control of flow equally well in both directions and is reversible to obtain extended service life. The fairing nut is placed on the downstream side of the valve to contribute to a uniform flow path.

AXIAL FLOW VALVE COMPONENTS
THREE MAJOR STRUCTURAL PARTS—ONE MOVING PART

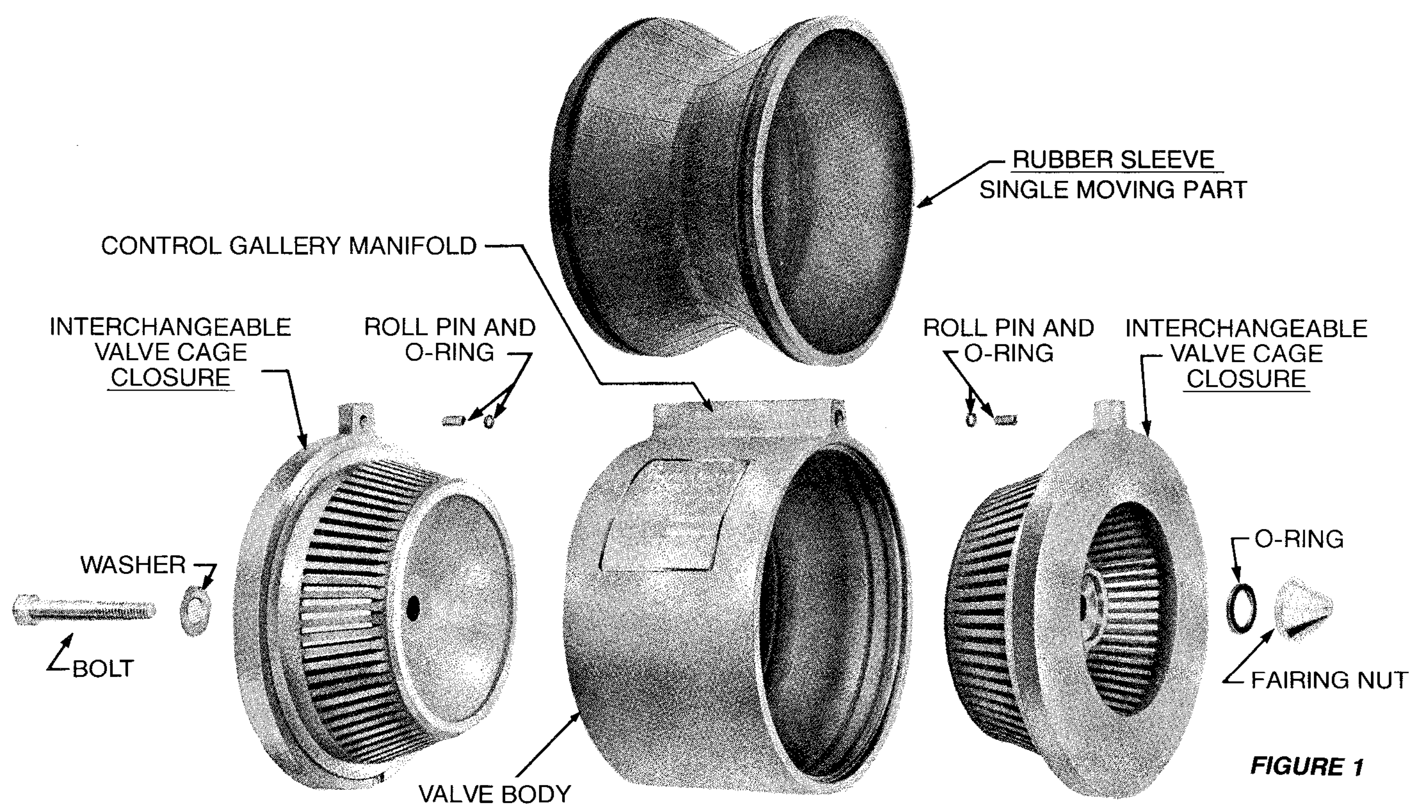


FIGURE 1

CONTROL PASSAGES *(Figure 2)*

The gallery of the valve body has three passages:

1. The inlet pressure normally supplies the control pressure. The inlet supply pressure passage is in the upstream closure and connects with the gallery.
2. The control passage branches into two annular grooves in the valve body. The annular grooves distribute control pressure around the sleeve when the sleeve is in the fully open or closed position.
3. The exhaust or downstream bleed passage is normally used to permit reduction in control pressure when opening the valve. The aspirating capability of this passage insures a fully expanded sleeve with minimal pressure differential.

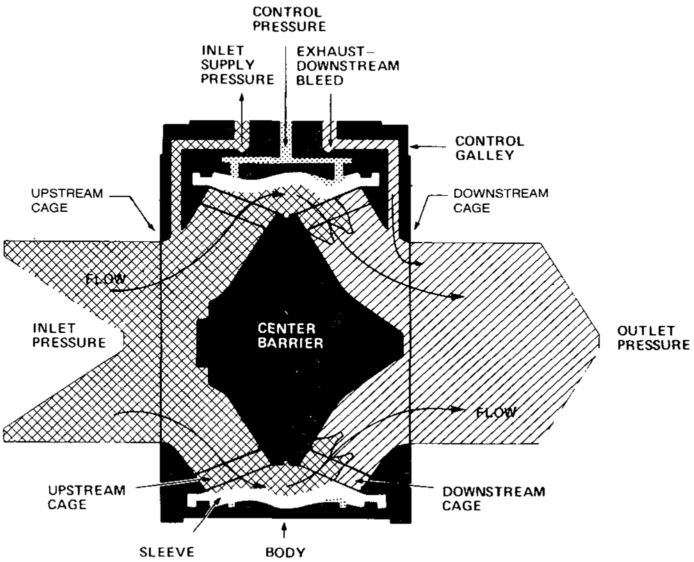


FIGURE 2

Closed Position (Figure 3)

The sleeve is molded to a smaller diameter than the cage diameter. When assembled in the valve, the sleeve exerts a closing preload on the upstream and downstream cages. The inner upstream surface of the sleeve is exposed to inlet pressure applied.

Control pressure (supplied by and equal to the inlet pressure) is against the exterior of the sleeve. The differential pressure on the upstream portion of the sleeve is 0 psi but the sleeve preload exerts a closing force. The differential across the downstream portion of sleeve is the difference between the upstream and downstream pressures. This differential plus the sleeve preload provides the closing force.

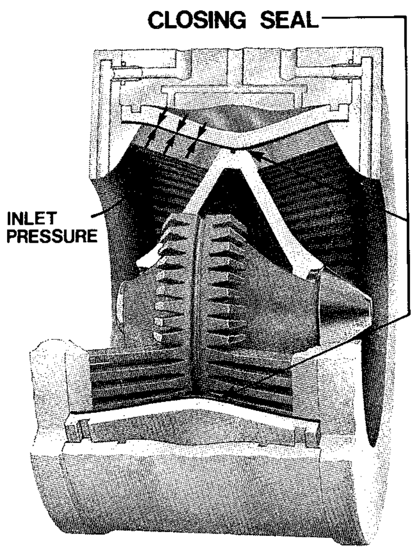
Throttling *(Figure 4)*

To open the valve control pressure must be reduced. A small decrease in the control pressure permits inlet pressure to lift the sleeve from the inlet cage. As the control pressure is further decreased, the central sleeve preload is overcome and the sleeve is peeled progressively away from the downstream cage. Flow through the valve commences when the tapered openings of the outlet cage are uncovered. Further decreases in control pressure uncover a greater area of the outlet cage. Throttling control is maintained when the control pressure reaches equilibrium and flow demand is satisfied.

Open Position *(Figure 5)*

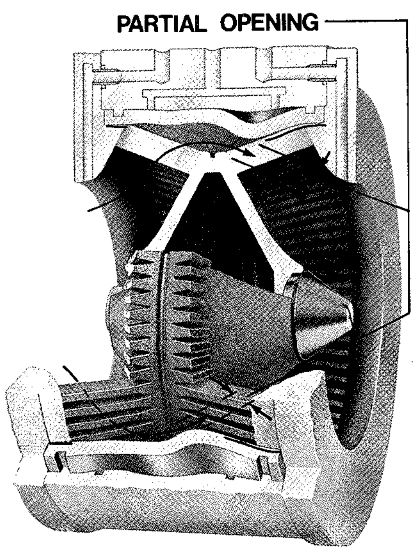
The valve is fully open when the drop in control pressure is sufficient to completely expose the slots in the downstream cage, and the sleeve is fully expanded against the body inner contour.

The control pressure drop is aided by aspiration through the downstream bleed aspiration port. At high rates of flow, the aspirated pressure in the bleed channel can be significantly lower than the downstream pipe line pressure, thereby minimizing the differential between inlet and outlet pressures required for full valve opening.



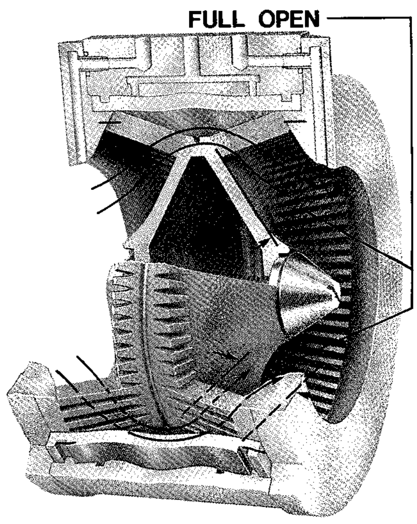
CLOSED POSITION

FIGURE 3



THROTTLING POSITION

FIGURE 4



OPEN POSITION

FIGURE 5

VALVE OPERATORS *(Figure 6)*

The Axial Flow Valve is essentially a pneumatic or hydraulic motor valve. To function, the valve requires some type of a valve operator.

The Axial Flow Valve is normally closed (if control and inlet pressure are equal). When closed, the closing forces are control chamber pressure acting on the sleeve exterior plus the elastic preload. Opening forces are inlet pressure acting on the interior of the sleeve through the inlet cage. To crack the valve, control pressure must be decreased so that inlet pressure can overcome the initial preload. To increase the opening, control pressure must be further reduced. To open the valve, control pressure must be reduced until inlet pressure has fully expanded the sleeve. Any further reduction of control pressures does not affect the valve operation. See page 6 for table of operating pressures.

To change the control chamber pressure two external valves are required.

Valve A - Controls the supply pressure. Usually, inlet pressure is used to supply control chamber pressure. Control chamber pressure closes the valve. In the majority of applications Valve A is an adjustable non-closing restrictor.

Valve B - Adjusts control chamber pressure and positions the sleeve. Valve B is usually a pilot pressure regulator.

A three-way connector is required to make connections to Valve A, Valve B and to control chamber.

On - Off
For On-Off applications, an adjustable restrictor is used for Valve A, and Valve B can be open or closed.

Manually - By means of handler buttons, levers or foot pedals.
Automatically - By means of electrical operated solenoids, mechanically operated lever or cams and motors.

Throttling
Throttling applications require the feedback of pressure which is utilized in controlling the position of Valve B.

Self-Operated
Self-operated applications are used in pressure control. Sensed pressure downstream is used for pressure reducing regulation. Sensed pressure upstream is used for relief valve and back pressure service.

Controllers
Controllers are used when precision control is required for severe operating conditions. Many combinations of pilots and pneumatic controllers can be used for flow, pressure, temperature, or process control. A controller does not normally act directly to position the sleeve but rather must act through a "pilot" or diaphragm motor valve interface.

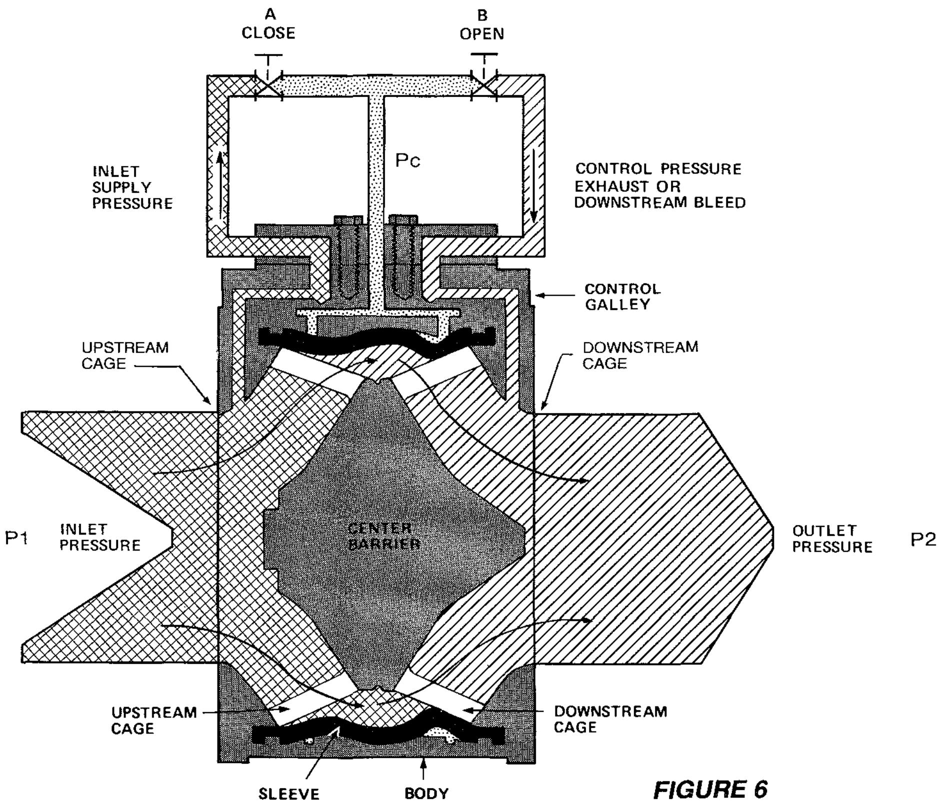


FIGURE 6

INSPIRATOR CONTROL MANIFOLD

for Low Differential Pressure

When equipped with an Inspirator Control Manifold, the American Axial Flow™ Valve provides accurate and proven pressure regulation in applications with very low differential pressures. The manifold extends the operating range of the AFV at low inlet pressures while maintaining the same maximum operating pressure ratings.

The Axial Flow Valve uses an elastomer sleeve which expands or contracts depending on the pressure differential across the sleeve. Once this differential exceeds the minimum cracking pressure, the sleeve expands allowing flow through the valve until downstream demand is supplied and the pressure is balanced across the sleeve.

With a conventional restrictor-type control manifold, the sleeve differential pressure cannot be greater than the total pressure drop across the valve. In some peak load applications, the inlet pressure can be reduced to the point where there isn't a sufficient differential between the inlet and the outlet (set) pressure to allow the valve to fully open. Or, in high pressure applications, the differential needed to fully open the valve may be greater than the available drop across the valve.

The Inspirator Control Manifold incorporates a specially designed nozzle ***(Figure 7)***. This nozzle reduces the sleeve control pressure (Pc) so that the differential across the sleeve (P_1-Pc) is approximately three times the differential across the valve(P_1-P_2). The Inspirator Control Manifold, in essence, acts like a differential pressure amplifier with a gain of 3. The maximum differential which the inspirator can generate is approximately 62% of the absolute inlet pressure. The adjustable restrictor shown is used to vary the response time of the sleeve.

The Inspirator Control Manifold extends the usefulness of Axial Flow Valves by reducing the differential pressure necessary to fully open the valve while maintaining the control sensitivity and control pressure accuracy. The inspirator control can be used in single valve pressure reduction applications and also in worker/monitor sets where the combined pressure loss is generally higher, resulting in less differential per valve. The Inspirator Control Manifold can be supplied for retrofit to Axial Flow Valves in the field, or can be ordered in place of the standard composite block manifold for new installations.

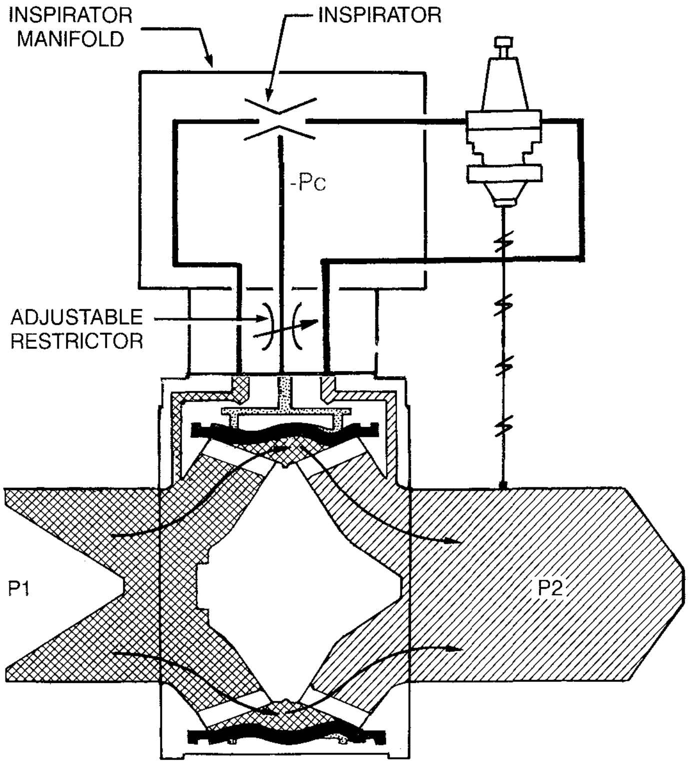


FIGURE 7

AXIAL FLOW VALVE OPERATING PRESSURES

AFV Series	Sleeve Number	Composite Block Manifold Operating Parameters		Inspirator Block Manifold Operating Parameters		Maximum Operating Conditions	
		Cracking	Full Open	Cracking	Full Open	Continuous	Intermittent
300	5L*	1.5 psid	5 psid	0.5 psid	1.7 psid	30 psid	50 psid
300	5	3.5 psid	15 psid	1.5 psid	7.5 psid	125 psid	180 psid
300	7	14 psid	30 psid	6 psid	19 psid	500 psid	720 psid
600	7	30 psid	60 psid	12 psid	25 psid	1000 psid	1440 psid

*2", 3", 4", 6" & 8" sizes only

See page 23 for Inspirator Manifold part numbers

CAPACITY LIMITER KIT

This Capacity Limiter Kit ***(Figure 8)*** is supplied as an option for 2", 3", and 4" standard trim Axial Flow Valves to reduce the full open capacity to a predetermined percentage of its rated capacity.

Two kits are available to reduce the capacity of an Axial Flow Valve to either 50% or 75% of the valve's rated capacity. Each kit consists of a bolt, a spacer and the Limiter. The flat faces of the Limiter are stamped with a number that reads 2-300-50 or 2-300-75. Check your Capacity Limiter to be certain it is correct for the intended application.

Additional and/or custom size limiters are available upon request.

KIT INSTALLATION INSTRUCTIONS

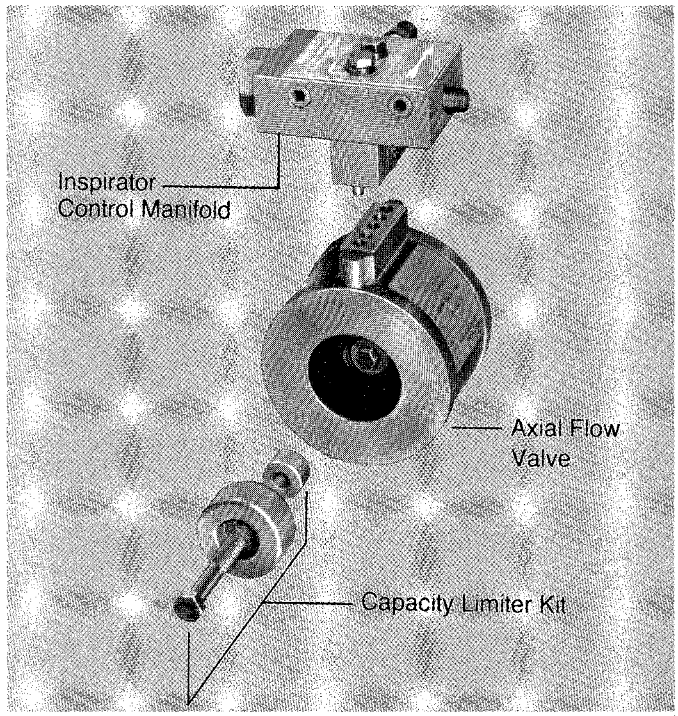
1. If the kit is for an AFV, remove the valve from the line.
2. Disassemble bolt, washer and fairing nut. Save the bolt and washer in the event future requirements necessitate a return to 100% capacity.
3. Assemble Limiter and spacer on new bolt with the desired 300 or 600 designation facing upstream. Install bolt in upstream end of valve, as shown in the figure. Do not use a washer. The faces of the Limiter and the AFV must be flush within .03". An improperly assemble Capacity Limiter will either project out beyond the AFV flange or be recessed by .19".
4. Check that O-Ring is seated in fairing nut groove. Assemble nut and tighten to:
   2" & 3" Torque to 20 to 30 ft/lbs.
   4" Torque to 40 to 60 ft/lbs.
5. Affix the appropriate label to AFV body, just below the existing badge. If valve body is dirty, clean before application.
6. Reassemble AFV to line.

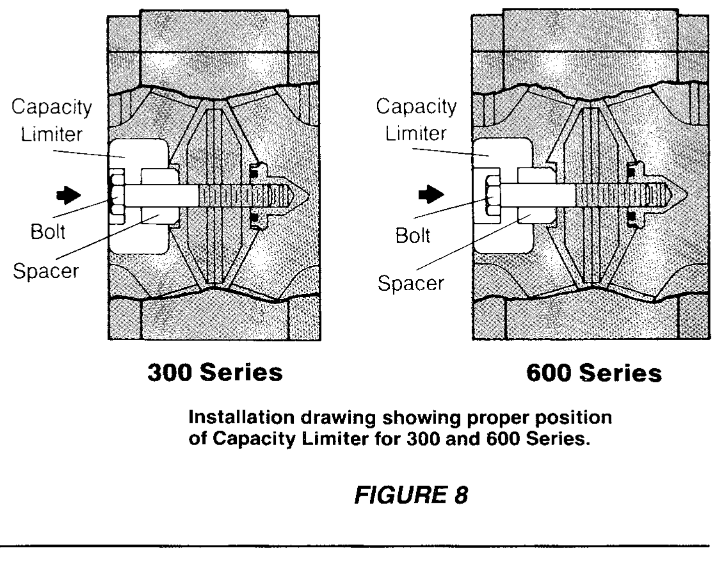
CAPACITY LIMITER REMOVAL

1. Depressurize and remove AFV from line.
2. Disassemble bolt, Limiter, spacer and fairing nut.
3. Install original 1.37" long bolt and washer.
4. Remove the reduced capacity label.
5. Reassemble AFV to line.

CAPACITY LIMITER KITS FOR AXIAL FLOW VALVES

VALVE SIZE	% OF FULL OPEN CAPACITY	CLASS 300 PART NUMBER	CLASS 600 PART NUMBER
2" AFV	50%	74075G036	74075G036
2" AFV	75%	74075G041	74075G041
3" AFV	50%	74075G055	N.A.
3" AFV	75%	74075G060	N.A.
4" AFV	50%	74075G074	74075G093
4" AFV	75%	74075G079	74075G098





Installation drawing showing proper position of Capacity Limiter for 300 and 600 Series.

FIGURE 8

BASIC CONTROL LOOPS

Pressure and Flow *(Figure 9, 10, 11)*

When the valve is open, inlet pressure radially expands the sleeve away from the upstream cage. Inlet pressure then peels the sleeve from the downstream cage. The amount of downstream cage uncovered depends on the opposing control pressure.

Flow enters the upstream closure and is directed through the upstream cage, then passes through the downstream cage closure.

Valve Operation

The valve is closed when the pilot regulator is closed and the upstream pressure has equalized through the restrictor acting against the exterior of the sleeve as a valve closing force.

When the valve is closed, the control pressure is equal to the inlet pressure. The valve begins to open when there is a reduction in control pressure which is greater than the sleeve preload. The valve is fully open when the drop in control pressure is sufficient to permit inlet pressure to completely expand the sleeve.

Valve Downstream Bleed

The valve downstream bleed is aspirated at high rates of flow by a venturi effect. The aspiration induces a drop in pressure in the valve downstream port. The induced drop in pressure aids the pilot to lower the control pressure when the valve approaches full open.

The valve downstream bleed port is not used for sensing. A stable pressure location must be used for feedback to the pilot.

Pilot Function - Pressure Regulation Service *(Figure 10)*

For pressure regulation, the pilot senses downstream pressure. A demand for flow will slightly reduce downstream pressure and will open the pilot valve. The effective opening of the pilot valve is regulated by changes in the downstream pressure sensed.

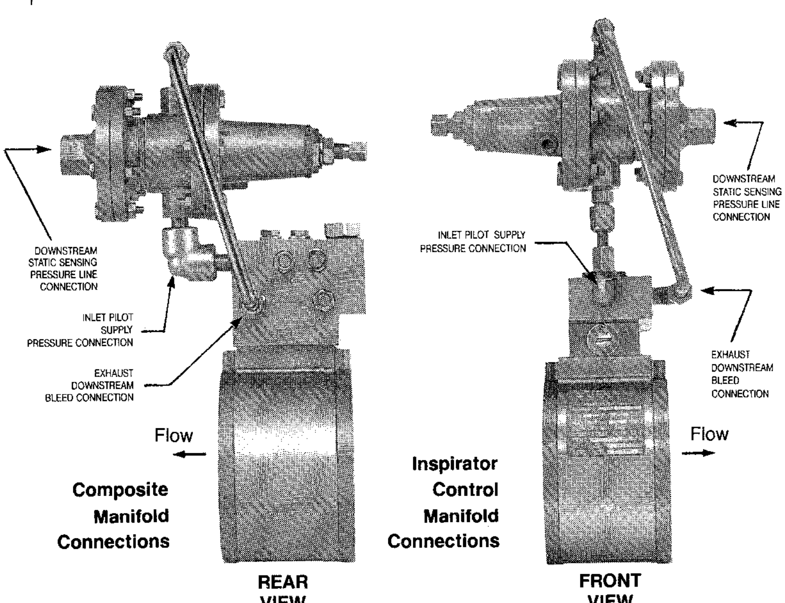


FIGURE 9

Pilot - Back Pressure Service and Relief Valve Operation *(Figure 11)*

For back pressure regulation and relief valve operation, the pilot senses upstream pressure. An increase in upstream pressure above the dead end shut off†† pressure causes the pilot valve to open and exhaust control pressure.

The effective opening of the pilot valve is regulated by upstream pressure changes sensed.

Restrictor Function and Setting

The restrictor causes a pressure drop from the upstream pressure to the control chamber pressure in relation to valving function providing sleeve expansion for the AFV sleeve. In most applications, a pilot performs the valving function.

†† Dead end shut off in this application is called relief pressure setting.

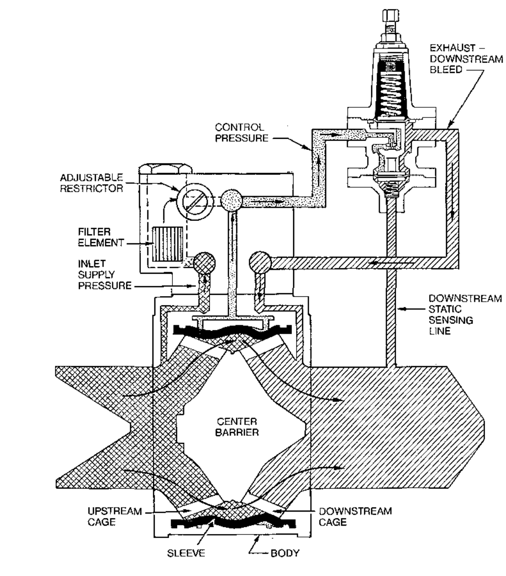


FIGURE 10

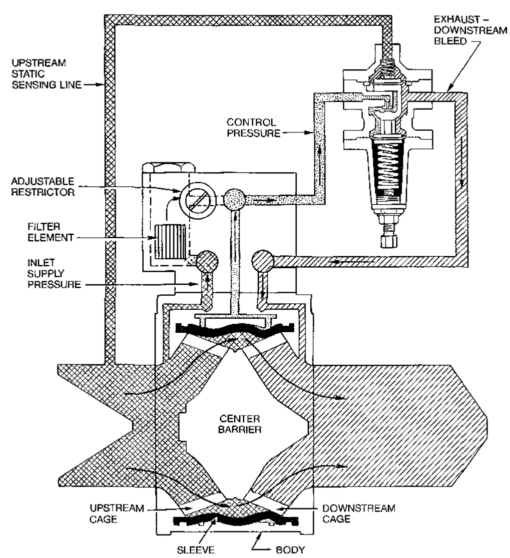


FIGURE 11

INSTALLATION

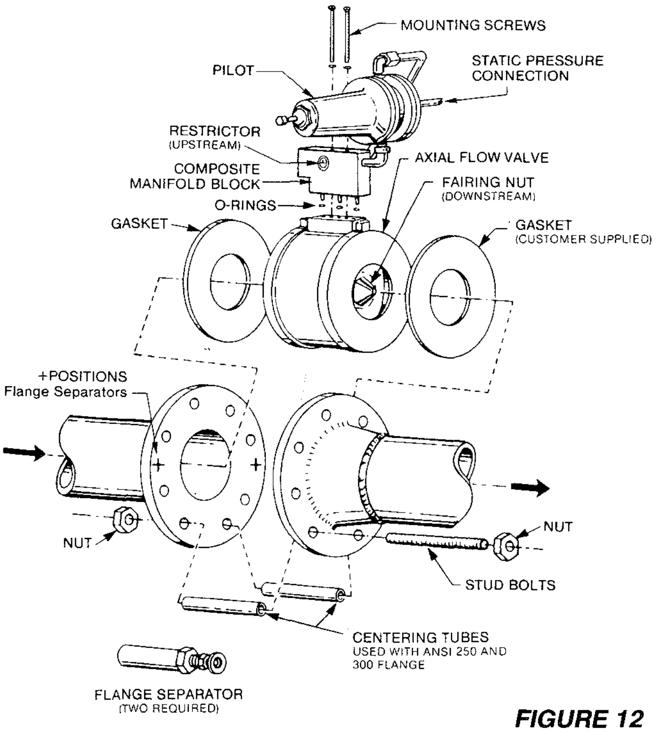


FIGURE 12

1. Assemble the control loop as indicated above (figure 12) with restrictor inlet position at the upstream of the Axial Flow Valve.
2. The assembly may be mounted on the smaller valves before the valve is mounted between the pipe flanges. Three O-rings are required. The O-rings slip on the roll pins which align the ports in the composite manifold with the ports in the Axial Flow Valve gallery.

   The larger Axial Flow Valves should be mounted between the pipe flanges before the control loop is mounted on the Axial Flow Valve.

   To facilitate the handling of heavier valves, a lifting plate is available. The lifting plate is attached to the gallery on the valve body with the composite manifold mounting screws and has a lifting opening (½″ × 1½″) which is suitable for engagement by a hook or cable.
3. Align the pipe flanges and insert the lower stud bolts. Use centering tubes over the two lowest stud bolts for the 250 and 300 ANSI flange installations, leaving sufficient space for the Axial Flow Valve.
4. If the pull-up space is less than desired, use the flange separators to increase the space. The Axial Flow Valve must be installed with its fairing nut on downstream side of the valve. Place the valve and gaskets between the flange. Place the nuts on the stud bolts.
5. Remove the flange separators (if used). Tighten the nuts evenly around the bolt circle. Assure that a minimum of one and one-half or more threads show beyond the nut.
6. Check the control loop and system for leaks to assure all the connections are tightened properly and that no tubing has been nicked or bent.

OPERATION

Pressure Reducing Regulator with Controller Pilot with ZSC-100 and Controller

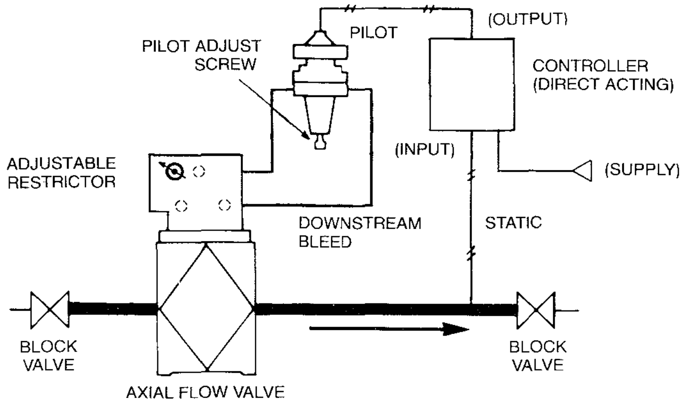


FIGURE 13

1. Set the restrictor to the number 3 setting.
2. Relax the pressure spring of the pilot regulator by backing out (turning counter clockwise) the adjustment screw.
3. Set the controller's proportional band and reset rate controls as recommended by the manufacturer for initial operation.
4. Set the controller's setpoint adjustment at the desired pressure.
5. Increase the controller's supply pressure to 20 psig.
6. Crack and then slowly open the downstream block valve.
7. Crack and then slowly open the upstream block valve.
8. Slowly increase (turn clockwise) the pilot regulator's adjustment screw until the controller outlet pressure gauge reads 9 psig.
9. Tune the controller in accordance with the manufacturer's recommendations.
10. Close the downstream block valve to check for Axial Flow Valve (AFV) lockup; then slowly reopen this valve.
11. Adjust controller set point to desired outlet pressure value.
12. Open the downstream block valuė fully and allow system to stabilize. Flowing conditions must be present through the system at this time, preferably at the minimum anticipated rate if possible.
13. Incrementally narrow (reduce) the proportional band setting in small steps, such as from 50% to 40% to 30%. During this adjustment process, upset the system either by changing flow rate or shifting the set point reference slightly. Allow ample time between each change in the proportional band for the full effect of the adjustment to be observed. Repeat adjustment of proportional band until the narrowest proportional band setting that will not produce objectionable cycling is reached.

14. If reset action is used, incrementally increase (open) reset rate to the system while upsetting the system as outlined in Step 13. Allow ample time after each adjustment for the effect of adjustment to be observed and the system again stablizes. In general, use the fastest reset rate that can be applied without increasing instability.

NOTE: The adjustment restrictor controls the rate of AFV opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above 4 tend to flood the control system; therefore, high settings should be avoided, unless required for control stability. Restrictor settings of 2 or 3 are normal under most conditions.

Pressure Reducing Regulator

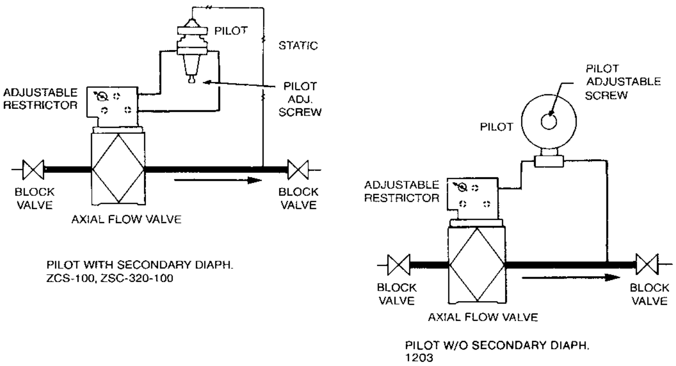


FIGURE 14

1. Set restrictor to maximum (No. 8) setting.
2. Relax pressure spring of pilot regulator by backing out adjustment screw until spring tension is at minimum.
3. Crack downstream block valve.
4. Crack upstream block valve to pressurize Axial Flow Valve (AFV).
5. Fully open upstream and downstream block valves.
6. Slowly increase pilot pressure spring tension until some downstream flow is achieved.
7. Reset restrictor (slowly) to No. 4 setting.
8. Slowly increase pilot pressure spring tension until downstream pressure approximates desired set pressure.
9. Tune system by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.
10. Close downstream block valve to check for AFV lockup.
11. Gradually open downstream block valve.

NOTE: The adjustable restrictor controls rate of valve opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above 4 tend to flood the control system; therefore they should be avoided unless required for control stability. Restrictor settings of 2 or 3 are normal under most conditions.

Two Stage Pressure Reduction

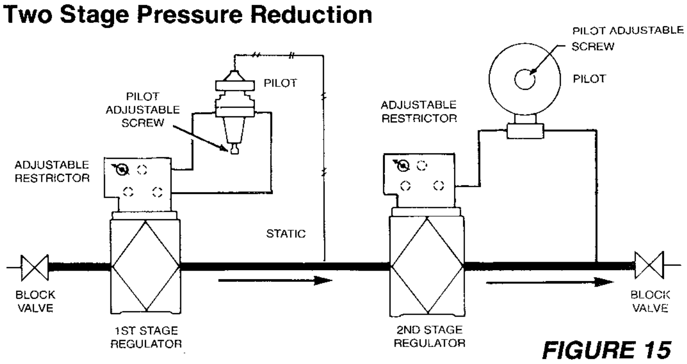


FIGURE 15

1. Set restrictors of both 1st and 2nd stage regulators to maximum (No. 8) setting.
2. Relax pressure spring of both pilot regulators by backing out adjustment screw until spring tension is at minimum.
3. Crack downstream block valve.
4. Crack upstream block valve to pressurize Axial Flow Valve (AFV).
5. Fully open upstream and downstream block valves.
6. Slowly increase pilot pressure of 1st stage until approximate desired intermediate pressure is indicated to inlet of 2nd stage.
7. Slowly reset 1st stage restrictor to No. 4 setting.
8. Slowly increase pilot pressure spring tension of 2nd stage regulator until approximate downstream pressure is achieved.
9. Gradually reset 2nd stage restrictor to No. 4 setting.
10. Tune 1st stage regulator by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.
11. Tune 2nd stage regulator in same manner.
12. Close downstream block valve to check for AFV lockup.
13. Gradually open downstream block valve.

NOTE: The adjustable restrictor controls rate of valve opening and closing. Low restrictor settings quicken the opening and closing. Restrictor settings above 4 tend to flood the control system; therefore, high settings should be avoided unless required for control stability. Restrictor settings of 2 or 3 are normal under most conditions.

Back Pressure Regulation and Relief

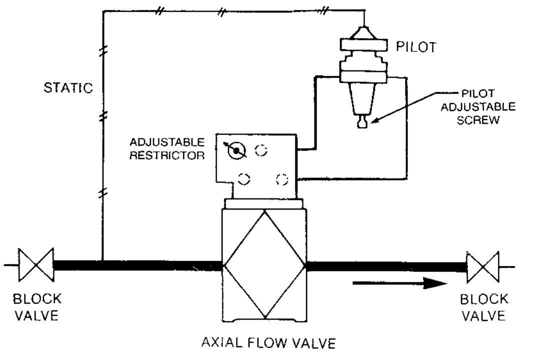


FIGURE 16

1. Set restrictor to maximum (No. 8) setting.
2. Increase pressure spring tension of pilot regulator by turning adjusting screw inward until maximum tension is attained.
3. Open downstream block valve (if used).
4. Gradually introduce inlet pressure to the AFV.
5. Gradually decrease pilot pressure spring tension until:
   (a) **Back pressure**—some downstream flow is achieved.
   (b) **Relief valve**—the desired set point is reached.
6. Reset restrictor to:
   (a) **Back pressure**—No. 4 setting.
   (b) **Relief valve**—The correct restrictor setting is determined at time of installation. Use the lowest restrictor setting which permits the Axial Flow Valve to reseat at a pressure greater than the normal line pressure. Settings from No. 8 to No. 4 are normal.
7. **Back Pressure only**—Slowly decrease pilot pressure spring tension until upstream pressure approximates desired set pressure.
8. **Back Pressure only**—Tune system by alternately adjusting the pilot pressure spring and restrictor until both required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.

Back Pressure Regulation with Controller

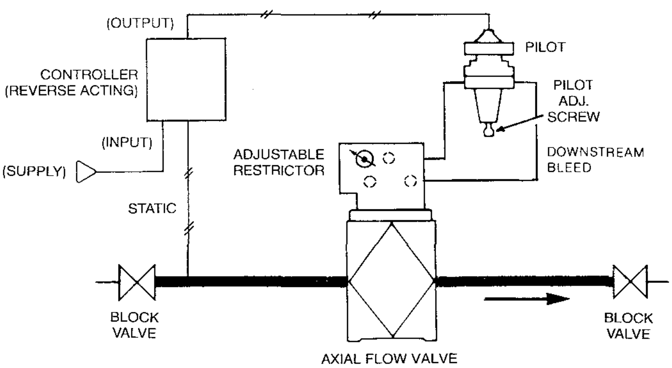


FIGURE 17

1. Set the restrictor to the number 8 setting.
2. Preset the pilot regulator by first fully backing out (turning counterclockwise) the adjusting screw, then advancing (turning clockwise) the adjusting screw until it contacts the adjusting spring, and finally advancing the adjusting screw two (2) complete turns.
3. Set the controller's proportional band and reset rate controls as recommended by the manufacturer for initial operation.
4. Set the controller's setpoint adjustment at the desired pressure.
5. Increase the controller's supply pressure to 20 psig.
6. Open the downstream block valve.
7. Crack and then slowly open the downstream block valve.
8. Slowly decrease (turn counterclockwise) the pilot regulator's adjustment screw until the controller outlet pressure gauge reads 9 psig.
9. Set the restrictor to the number 3 setting.
10. Tune the controller in accordance with the manufacturer's recommendations.
11. Adjust controller set point to desired outlet pressure value.
12. Open the downstream block valve fully and allow system to stabilize. Flowing conditions must be present through the system at this time, preferably at the minimum anticipated rate if possible.
13. Incrementally narrow (reduce) the proportional band setting in small steps, such as from 50% to 40% to 30%. During this adjustment process, upset the system either by changing flow rate or shifting the set point reference slightly. Allow ample time between each change in the proportional band for the full effect of the adjustment to be observed. Repeat adjustment of proportional band until the narrowest proportional band setting that will not produce objectionable cycling is reached.
14. If reset action is used, incrementally increase (open) reset rate to the system while upsetting the system as outlined in Step 14. Allow ample time after each adjustment for the effect of adjustment to be observed and thc system to again stablize. In general, use the fastest reset rate that can be applied without increasing instability.

NOTE: The adjustment restrictor controls the rate of AFV opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above 4 tend to flood the control system; therefore, high settings should be avoided, unless required for control stability. Restrictor settings of 2 or 3 are normal under most conditions.

Downstream Monitoring

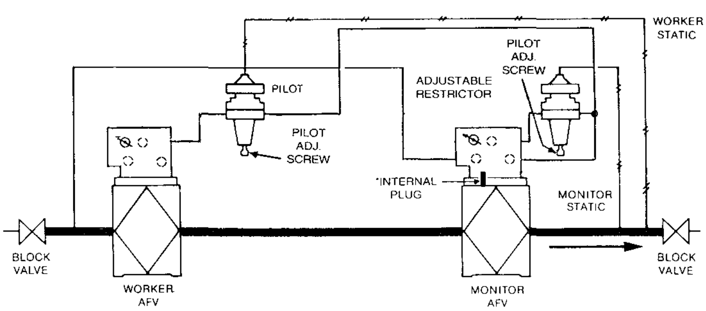


FIGURE 18

1. Set restrictors of both worker and monitor to maximum (No. 8) setting.
2. Relax pressure spring of monitor pilot regulator by backing out the adjustment screw until spring tension is at minimum.
3. Increase pressure spring tension of worker pilot regulator to maximum by turning adjusting screw inward.
4. Crack downstream valve slightly open.

*See Internal Plug Installation on page 13.

5. **Slowly** crack upstream block valve open to pressurize Axial Flow Valves.
6. Fully open upstream and downstream block valves.
7. Reset monitor restrictor to No. 4 setting.
8. Reset worker restrictor to No. 2 setting.
9. Slowly increase monitor pilot pressure spring tension until downstream pressure approximates desired monitor set pressure.
   NOTE: See table below of "suggested monitor/regulator set point differentials."
10. Tune monitor by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.
11. Reset worker restrictor to No. 4 setting.
12. Slowly increase worker pilot pressure spring tension until worker regulator assumes control and the downstream pressure approximates desired worker set pressure.
13. Tune worker in same manner as outlined in step No. 10.
14. Close downstream block valve to check for AFV lockup.
15. Gradually open downstream block valve.

NOTE: The adjustable restrictor controls the rate of valve opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above No. 4 tend to flood the control system; therefore they should be avoided unless required for control stability.

TABLE OF SUGGESTED WORKING AND MONITOR REGULATOR Set Pressure Differentials	
Working Regulator Set Points	Monitor Regulator Set Points
8" w.c. to 28" w.c.	2 to 5" w.c. above worker
1 psig to 5 psig	¼ to ¾ psig " "
5 psig to 10 psig	½ to 1 psig " "
10 psig to 30 psig	1 to 2 psig " "
30 psig - Up	5% of maximum spring range adjustment above worker set pressure

NOTE: The differentials in set pressures listed are intended as a guide only. Differentials in settings greater than those listed can be used if desired. Differentials less than those listed are possible in many systems.

Passive Upstream Monitoring

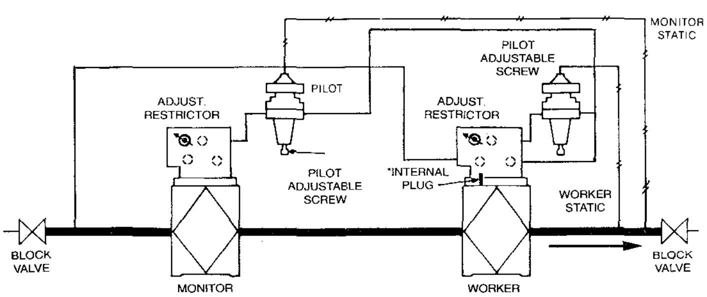


FIGURE 19

*See Internal Plug Installation on Page 13

Setting Worker in Service

1. Set restrictors of both worker and monitor to maximum (No. 8).
2. Relax pressure spring of worker pilot regulator by backing out the adjustment screw until spring tension is at minimum.
3. Increase pressure spring tension of monitor pilot to maximum by turning adjusting screw inward.
4. Crack downstream block valve.
5. Slowly crack upstream block valve to pressurize Axial Flow Valve (AFV).
6. Fully open upstream and downstream block valves.
7. Reset monitor restrictor to No. 2.
8. Slowly increase pilot pressure spring tension of worker until some downstream flow is achieved.
9. Slowly reset worker restrictor less than No. 4 setting.
10. Slowly increase worker pilot pressure spring tension until downstream pressure approximates desired worker set pressure.
11. Tune AFV worker by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.

Setting Monitor in Service

1. Slowly decrease monitor pilot pressure spring tension until it begins to assume control from the worker.
2. Fail worker wide open by disconnecting sense line or increasing set point above desired monitor set pressure.
3. Tune monitor by alternately adjusting pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.
4. Place worker back in operation by reversing action No. 2 above.
5. Close downstream block valve to check for AFV lockup.
6. Gradually open downstream block valve.

NOTE: The adjustable restrictor controls the rate of valve opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above No. 4 tend to flood the control system therefore they should be avoided unless required for control stability. Restrictor settings of 2 or 3 are normal under most conditions.

Two Stage Regulation with Monitor Override

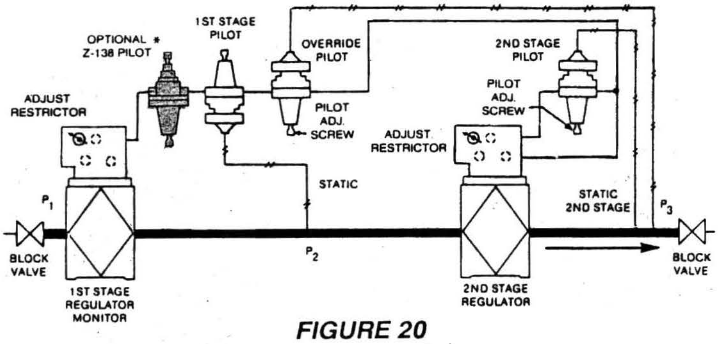


FIGURE 20

NOTES:

1. The maximum inlet pressure (P_1) for this system is limited to the maximum first stage pilot spring adjustment of the highest standard spring range (225 psi for ZSC or 600 psi for ZSC-320).

* **2.** For increased inlet pressure applications a type Z-138 pilot can be added between the manifold and 1st stage pilot as shown by the grey pilot shown in Fig. 20.

1. Set restrictors of both first and second stage regulators to maximum (No. 8) setting.
2. Relax pressure spring of both first and second stage pilot regulators by backing out adjustment screw until spring tension is at minimum.
3. Increase pressure spring tension of override pilot to maximum by turning adjusting screw inward.
4. Crack downstream block valve.
5. Crack upstream block valve to pressurize Axial Flow Valve (AFV).
6. Fully open upstream and downstream block valves.
7. Slowly increase pilot pressure of first stage until approximate desired intermediate pressure is indicated to the inlet of second stage.
8. Slowly reset first stage restrictor to No. 4 setting.
9. Slowly increase pilot pressure spring tension of second stage regulator until approximate downstream pressure is achieved.
10. Gradually reset second stage restrictor to No. 4 setting.
11. Tune first stage regulator by alternately adjusting the pilot pressure spring and restrictor until both the required set point and stable control is achieved at the lowest possible restrictor setting under normal flow conditions.
12. Tune second stage regulator in the same manner.

Setting Monitor Override in Service

1. Slowly decrease monitor override pilot pressure spring tension until it begins to assume control from the second stage regulator.
2. Fail second stage regulator wide open by disconnecting the second stage pilot static line or increasing set point above desired monitor set pressure.
3. Adjust monitor override pilot pressure spring to desired monitor set point without adjusting first stage restrictor as set in No. 8 above.
4. Place worker back in operation by reversing action of step No. 2.

5. Close downstream block valve to check for AFV lockup.
6. Gradually open downstream block valve.

Notes:

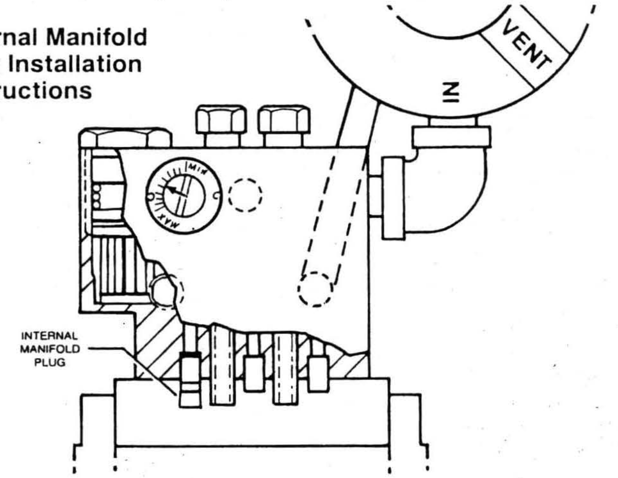
1. The adjustable restrictor controls the rate of valve opening and closing. Low restrictor settings quicken the opening and slow the closing. Restrictor settings above No. 4 tend to flood the control system; therefore they should be avoided unless required for control stability.

2. A numerically combined restrictor setting total is limited to 3½ when two pilots share a single aspirator port and full open AFV's are required at minimum pressure drops.

3. Complete lockup of station will not be achieved until the second stage outlet pressure (P_3) reaches the lockup pressure of the override pilot.

4. Restrictor settings of 2 or 3 are normal under most conditions.

Internal Manifold Plug Installation Instructions



Downstream monitoring and passive upstream monitoring applications require the use of an internal inlet plug to block the pilot supply and to prevent pressure build-up in the intermediate piping between the two Axial Flow Valves. This plug is available as a retrofit kit; order Kit Number 74036K001

NOTE: The internal manifold plug must be used in the downstream valve only.

1. The control loop normally has three (3) roll pins pressed into the manifold at the gallery interface surface. Remove the roll pin at the inlet port with a pair of pliers.
2. Spread a small amount of silicon grease or petroleum jelly over the O-ring and wipe so that the ring is covered with a thin film of lubricant.
3. Carefully slide the O-ring over the plug and into the O-ring groove machined into the plug.
4. Inspect the inlet port in the AFV gallery and remove all water or solid debris.
5. Slide the plug into this port so that the O-ring is completely covered by the port in the gallery.
6. The plug will protrude from the gallery.
7. Reassemble the control loop to the gallery, after visually inspecting the O-rings that fit into the grooves in the manifold around the roll pins.
8. **CAUTION:** The plug must also be inserted into one of the O-rings mentioned in step #7, or a joint leak will result.
9. Establish pressure supply to the AFV and inspect the joint between the gallery and manifold block for leaks, using a soap solution in warm water or removing the valve from the site to a heated building and test with air in cold weather environments.

INTRODUCTION

The following instructions cover the installation of the Inspirator Control Manifold ***(Figure 21)*** in both new and retrofit applications. The Inspirator Control Manifold is intended for low differential pressure service and replaces the standard control manifold.

RETROFIT INSTALLATIONS

Begin installation by closing block valves up and downstream of the existing Axial Flow Valve and sense lines. Bleed the valve pressure to zero.

Disconnect the bleed and sense lines from the pilot. Remove the two bolts holding the existing manifold to the valve body. Lift off the manifold and pilot. Disconnect the pilot from the manifold.

Bolt the new Inspirator Control Manifold to the Axial Flow Valve using the bolts supplied, so that the flow direction arrow is pointed in the right direction.

NEW INSTALLATIONS

For new installations, follow the Inspirator Control Manifold assembly instructions above.

Refer to the installation drawings included with the retrofit kit for pilot connections; the ZSC-100 and ZSC 320-100 ***(Figure 22)*** and the 1203 pilot ***(Figure 23)*** for pressure reduction and the ZSC-150 and ZSC 320-150 ***(Figure 24)*** for pressure relief. Also refer to the schematic diagrams for installation of sense and bleed lines in single valve ***(Figure 25)*** worker/monitor ***(Figure 26)*** and relief/back pressure applications. ***(Figure 27)***

IMPORTANT NOTE

*In worker/monitor installations where the worker is downstream of the monitor and worker inlet pressure sense line is connected upstream of the monitor **(Figure 26)**, a modification to the worker control manifold is necessary. The inlet pressure sense line is connected to the left side of the manifold block and a plug is inserted in the inlet pressure supply port. Refer to **(Figure 28)** and its instructions for installation of the worker manifold plug.*

INITIAL SET-UP, SINGLE STAGE PRESSURE REDUCTION

1. Set the sensitivity control to maximum setting (No. 8).*
2. Relax pressure spring of pilot regulator by backing out adjustment screw until spring tension is at a minimum.
3. Crack downstream block valve.
4. Crack upstream block valve to pressure Axial Flow Valve.
5. Fully open upstream and downstream block valves.
6. Slowly increase pilot pressure spring tension until some downstream flow is achieved.
7. Slowly increase pilot pressure spring tension until downstream pressure approximates desired set pressure.
8. Tune system by alternately adjusting the pilot pressure spring and the sensitivity control until the set point and stable control are achieved at the highest possible sensitivity setting under normal flow conditions.
9. Close downstream block valve to check for AFV lockup.
10. Gradually open downstream block valve.

*The sensitivity control adjusts the rate of valve opening and closing. High sensitivity settings cause the valve to open and close faster while lower settings reduce the response. A restrictor setting of 4 is normal under most conditions.

INSPIRATOR CONTROL MANIFOLD
Cut-away view, top

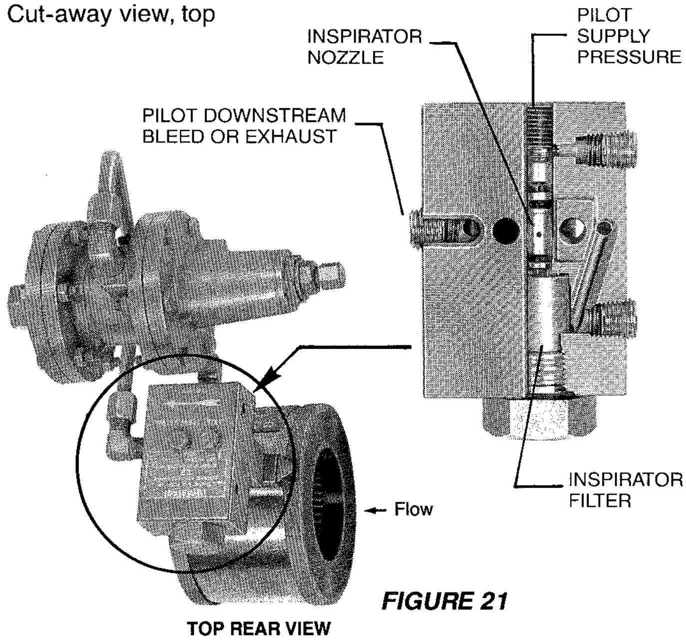


FIGURE 21

Pressure Reduction ZSC-100 and ZSC 320-100 PILOT

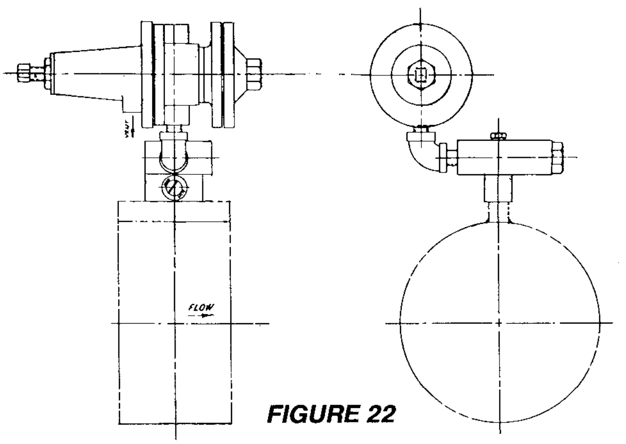


FIGURE 22

Pressure Reduction 1203 PILOT

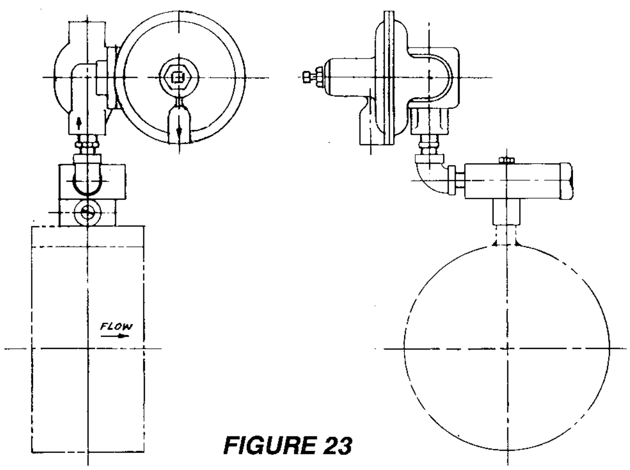


FIGURE 23

INITIAL SET-UP, WORKER/MONITOR PRESSURE REDUCTION

Setting the Worker:

1. Set the sensitivity control of both worker and monitor to maximum setting (8.)*
2. Relax the pressure spring of worker pilot by backing out the adjusting screw until spring tension is at minimum.
3. Increase pressure spring tension of monitor to maximum of pressure spring range by turning adjusting screw inward.
4. Crack downstream block valve.
5. Crack upstream block valve to pressurize Axial Flow Valve.
6. Fully open upstream and downstream block valves.
7. Slowly increase pilot pressure spring tension of worker until some flow is achieved.
8. Slowly increase worker pilot pressure spring tension until downstream pressure approximates desired set pressure.
9. Tune AFV worker by alternately adjusting the pilot pressure spring and sensitivity control until both the required set point and stable control is achieved at the highest possible sensitivity setting under normal flow conditions.

Setting the Monitor:

1. Slowly decrease monitor pilot pressure spring tension until it begins to assume control from the worker.
2. Fail worker wide open by disconnecting sense line or increasing set point above desired monitor set pressure.
3. Tune monitor by adjusting pilot pressure spring and sensitivity control until both the required set point and stable control are achieved at the highest possible sensitivity control setting under normal flow conditions.
4. Place worker in operation by reversing action of No. 2 above.
5. Close downstream block valve to check for AFV lockup.
6. Gradually open downstream block valve.

*The sensitivity control adjusts the rate of valve opening and closing. High sensitivity settings cause the valve to open faster while lower settings reduce the response time. Restrictor setting of 4 is normal under most conditions.

INITIAL SET-UP, BACK PRESSURE AND RELIEF

1. Set sensitivity control to maximum setting (8.)*
2. Increase pressure spring tension of pilot by turning adjusting screw inward until maximum tension is attained.
3. Open downstream block valve if used.
4. Gradually introduce inlet pressure to the AFV.
5. Gradually decrease pilot pressure spring tension until:
   (a) **Back Pressure**—some downstream flow is achieved.
   (b) **Relief Valve**—the desired set point is reached.
6. **Back Pressure only**—slowly decrease pilot pressure spring tension until upstream pressure approximates desired set pressure. Tune system by alternately adjusting the pilot pressure spring and the sensitivity control until both the required set point and stable control are achieved at the highest possible under normal flow conditions.

*The sensitivity control adjusts the rate of valve opening and closing. High sensitivity settings cause the valve to open faster while lower settings reduce the response time. Restrictor setting of 4 is normal under most conditions.

Pressure Relief ZSC-150 ZSC and 320-150 PILOT

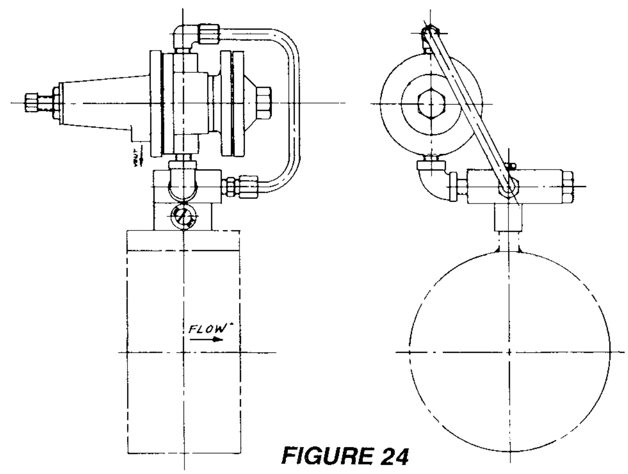


FIGURE 24

Single Valve Pressure Application

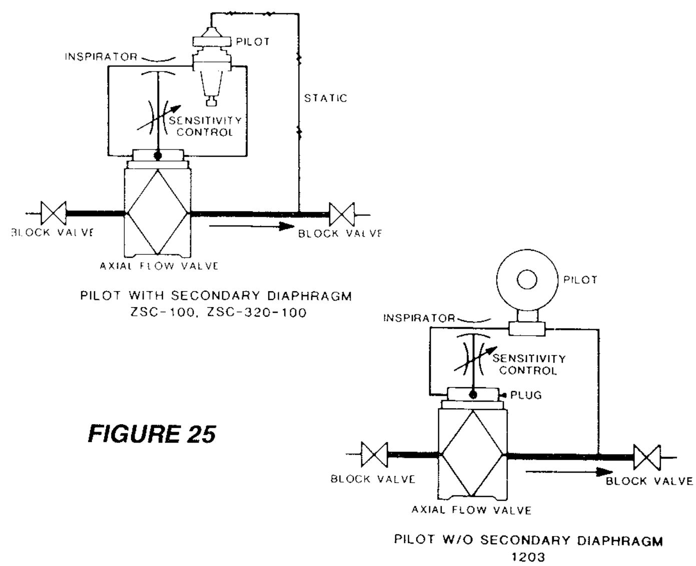


FIGURE 25

Worker/Monitor Pressure Application

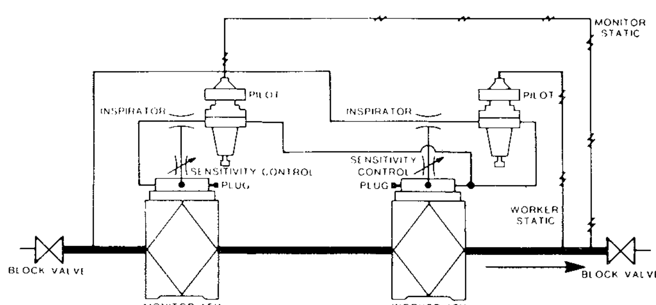


FIGURE 26

Relief/Back Pressure Application

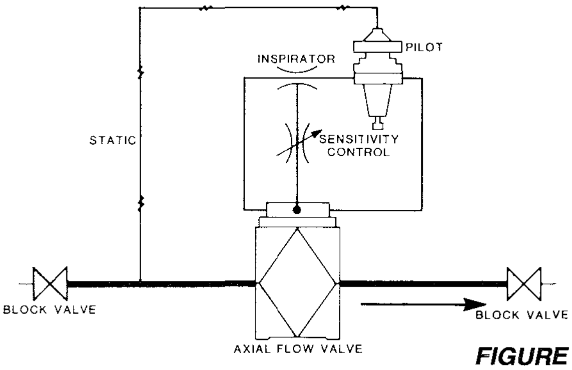


FIGURE 27

MANIFOLD INSPECTION AND MAINTENANCE

Restrictor Core: The restrictor core should be inspected at all normal service periods, or when control pressure begins to deteriorate, for dirt build up on the restrictor groove and wear of the two O-rings.

To remove the restrictor core from either the inspirator or composite manifold, depressurize the valve, remove the retaining ring holding the core in place and slide the core out from the manifold.

Inspect the restrictor core and clean any debris that may have collected in the restrictor groove. Also inspect both O-rings for any sign of wear, replace if necessary and always lightly lubricate the O-rings before reinstalling the restrictor core.

On completion, slide the restrictor core back in place, reattach the retaining ring to the restrictor core and adjust restrictor to the previous setting.

Composite Manifold Filter: The composite manifold filter element should be inspected at all normal service periods or when set control pressure begins to deteriorate.

To remove the filter for inspection or replacement, depressurize and unscrew the large hex head plug with O-ring on top of the manifold.

Remove the spring, washer and gasket in this order. Remove the filter and replace with a new filter element, (part no. 78480P001) *making sure the closed end of the filter element goes in first.* Reverse the removal steps above for replacement making sure the hex head O-ring is lubricated.

Inspirator Manifold Filter: The inspirator manifold filter should be inspected at all normal service periods or when set control pressure begins to deteriorate.

To remove the filter for inspection or replacement, depressurize the valve and unscrew the large hex head plug on the side of the manifold.

The filter utilizes a compression fit inside of the hex head plug. Simply remove the old filter element and replace with the new element (part no. 74074K001) making sure a secure fit is achieved.

Next, replace the hex head O-ring with the new O-ring supplied, lubricate the O-ring and screw the hex head plug with filter back into the manifold port until tight.

WORKER MANIFOLD PLUG INSTALLATION

Note: *System must be depressurized before servicing*

1. Remove the Inspirator Composite Manifold Block Assembly from the Axial Flow Valve by removing the hex head cap screws.
2. Separate the Inspirator Block Assembly from the Restrictor Block. (Be sure not to lose the O-Rings).
3. Inspect the inlet port in both blocks and remove any moisture or debris.
4. Install internal screw plug (set screw, cone point, MG × 1.0 × 6g. 12 mm long) into internal pressure supply port of the Inspirator Block.
5. Reassemble the Inspirator and Restrictor Blocks, making sure the three (3) O-Rings between Restrictor Block and Inspirator Block are in place.
6. Reassemble the Inspirator Composite Manifold Block Assembly to the Axial Flow Valve, making sure the three (3) O-Rings are properly seated between the AFV and the Manifold Block Assembly.
7. Establish pressure supply to the AFV and be sure to inspect the joints between the AFV and Restrictor Block and between Restrictor Block and Inspirator Block for leaks, using a soap solution.

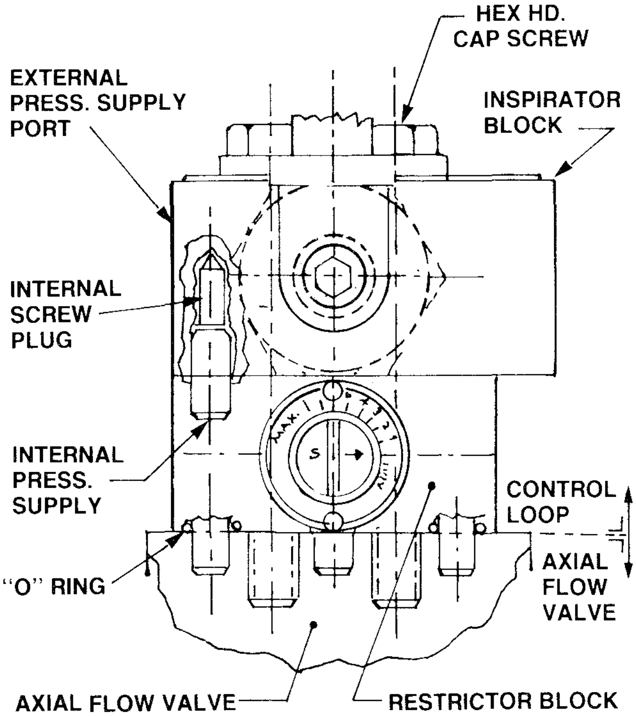
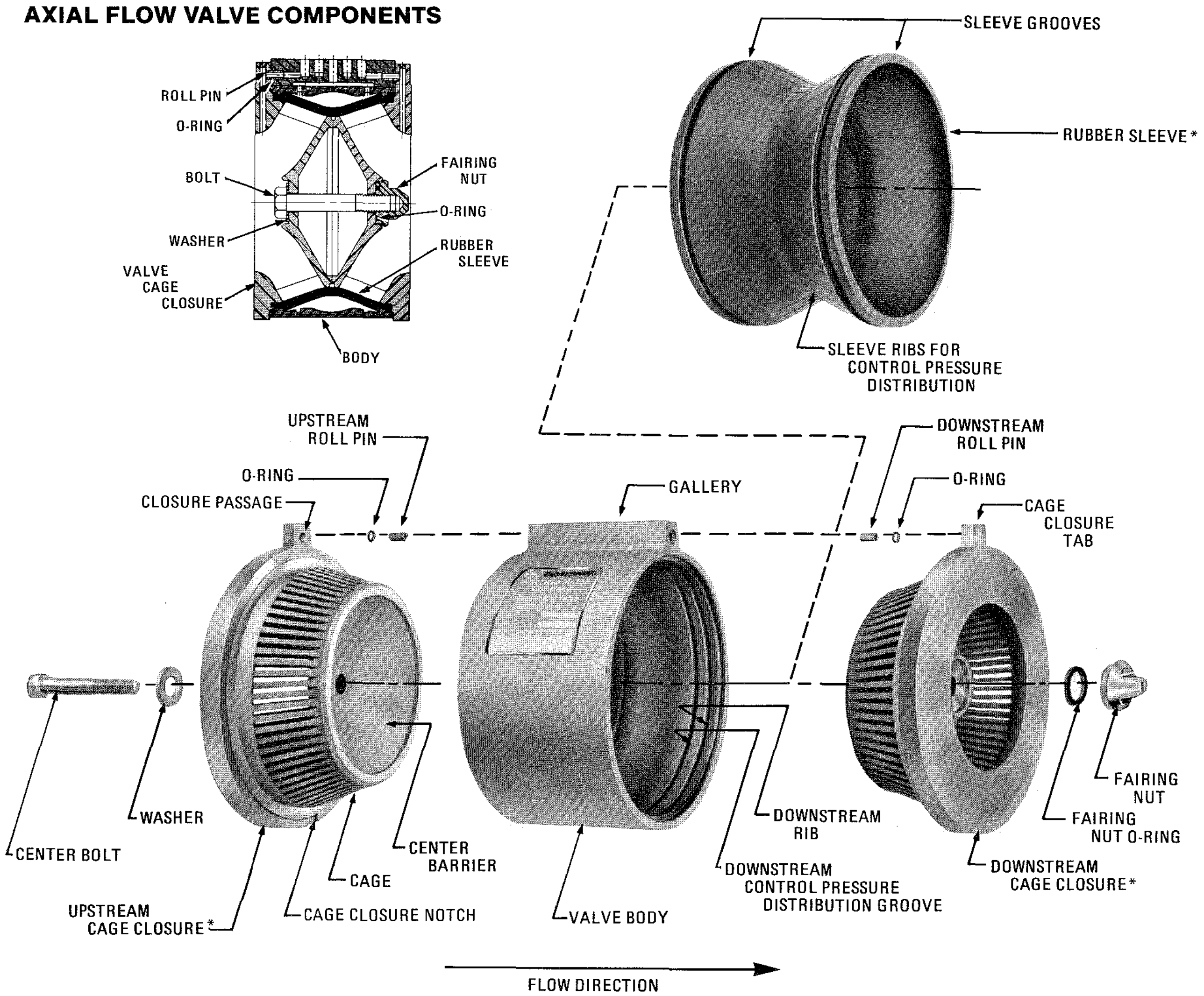


FIGURE 28

AXIAL FLOW VALVE COMPONENTS



*CAGE CLOSURES ARE INTERCHANGEABLE. RUBBER SLEEVE CAN BE INSTALLED IN EITHER DIRECTION.
THE AXIAL FLOW VALVE IS CAPABLE OF BI-DIRECTIONAL FLOW CONTROL.

FIGURE 29

DISASSEMBLY

Under normal operating conditions, the Axial Flow Valve is capable of long service. The service life can be markedly increased by timely inspections and by reversing the upstream and downstream ends of the rubber sleeve.

1. Clean exterior of Valve.

2. To remove the single center bolt, it is necessary to stop the fairing nut from turning by use of a wrench on the nut flats. Loosen the center bolt by using a socket wrench on the hex head of the bolt. ***(Figure 30)***

NOTE: The fairing nut has been provided with flat wrench surfaces for holding the nut. Some models have a slotted fairing nut which requires the use of a screwdriver. Do not turn the fairing nut to loosen the center bolt. This could result in "O" ring damage.

3. Remove bolt and washer, and fairing nut and O-ring. ***(Figure 31)***

4. Insert screwdriver in the cage closure notch ***(Figure 32)*** and turn to loosen cage from body. Continue to raise cage closure with screwdriver until the screwdriver can be inserted near the gallery. Pry the cage closure from the roll pin in the gallery. The cage closure can now be removed. Take care not to damage the machined faces of the body or cage closure.

5. Carefully remove O-ring from roll pin. ***(Figure 33)***

6. Repeat Step 4 and remove the other cage closure. Keep downstream cage closure to the right for purpose of identification.

7. Carefully remove O-ring from roll pin.

8. Mark downstream edge of sleeve with chalk or soft pencil.

9. Loosen sleeve from both ends of body by pulling sleeve toward center and breaking seal. (If prying is necessary, use a smooth rounded instrument.) ***(Figure 34)***

10. Using your hand, force a section of the sleeve toward opposite side. ***(Figure 35)***

11. Grasp the fold in the sleeve, make sure the sleeve is free of both annular ribs in the body, and lift sleeve from body. ***(Figure 36)***

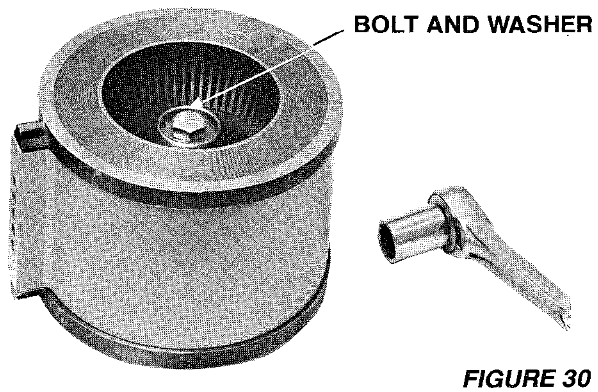


FIGURE 30

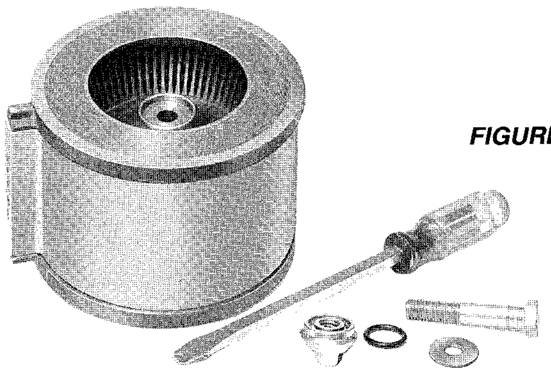


FIGURE 31

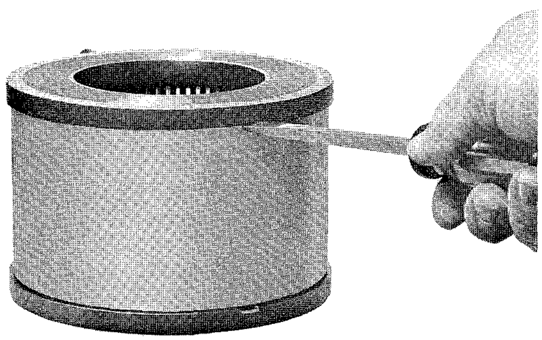


FIGURE 32

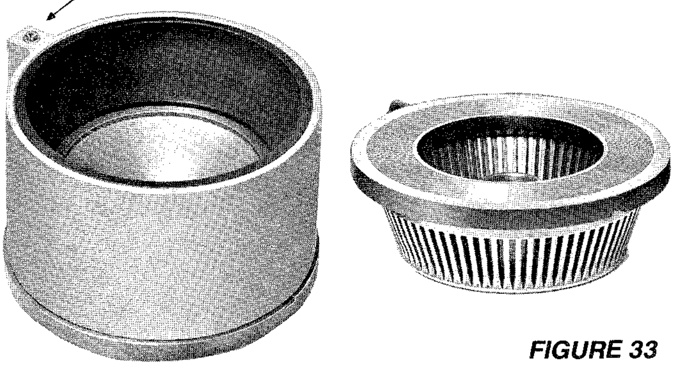


FIGURE 33

FIGURE 34

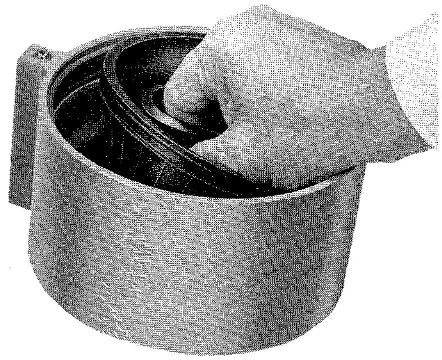


FIGURE 35

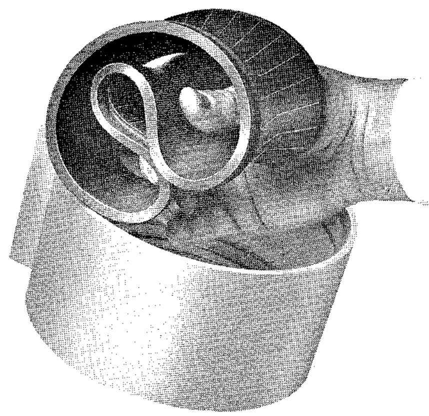


FIGURE 36

REFER TO IMPORTANT HANDLING INFORMATION ON PAGE 2

INSPECTION

1. Inspect upstream and downstream cage closure roll pins. Replace if damaged.
2. Inspect interior of valve body for unusual marks or corrosion. Clean thoroughly. Blow out gallery passages ***(Figure 37)***. The central control pressure passage has two interior ports. Be certain both have no blockage.
3. Inspect exterior of body for damage. Inspect weld between body and gallery.
4. Clean cage closure ***(Figure 38)***. Inspect for erosion and keep track of the downstream cage closure by placing it to the right. Discard cage closure that shows noticeable erosion or has reduced the thickness or width of the cage ribs. (A slight rounding of edges of the ribs will not affect the valve.)
5. Inspect sleeve before cleaning. Note any unusual marks and imprints. Check the sleeve for swelling or any noticeable change in hardness (flexibility).
6. Clean the sleeve carefully checking the areas where unusual marks or imprints were observed. Look for wear and breaks in sleeve surface.
7. Discard and replace with new sleeve if any defects other than normal wear are observed.
8. Inspect bolt, washer, and fairing nut for pits and corrosion.
9. It is usually good practice to replace O-rings. If there are no distortion, nicks, excessive swelling, or hardening, it is possible to reuse the O-rings.

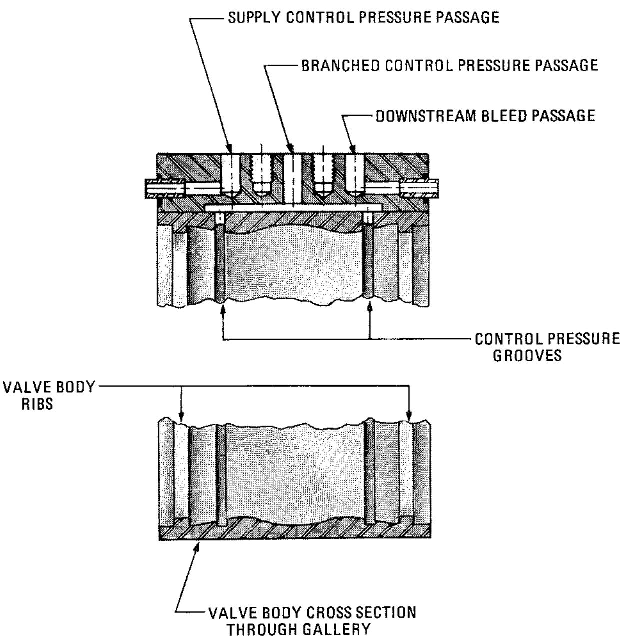


FIGURE 37

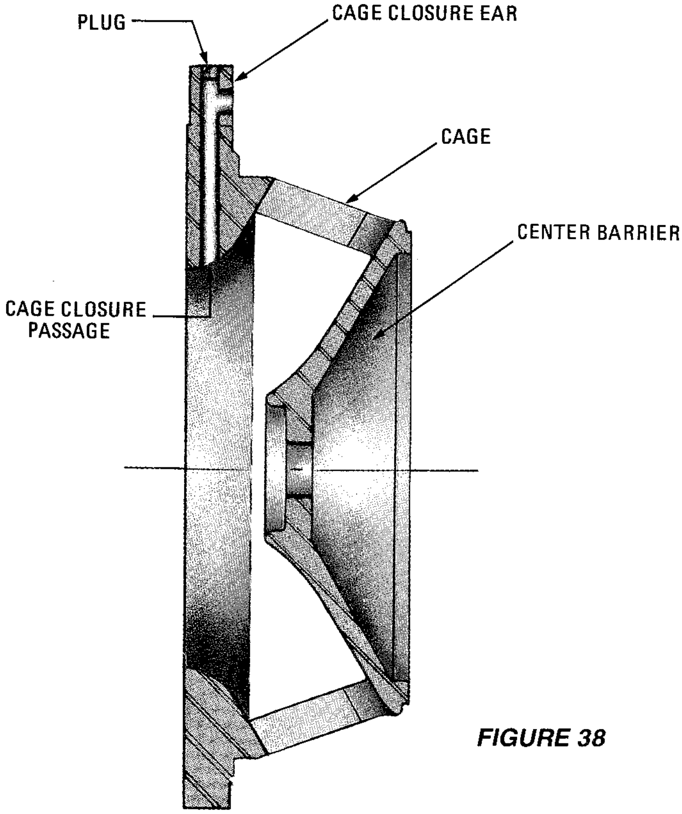


FIGURE 38

REASSEMBLY

1. Use the former downstream cage in the upstream side. Turn the sleeve so that the former downstream side faces upstream. Using spray type silicone lubricant, lightly lubricate the sleeve grooves and opposing internal surfaces. Lightly lubricate the two gallery O-rings.
2. Push the section of the sleeve toward the opposite side and grasp the fold. ***(Figure 39)***
3. Insert the folded sleeve in the body and engage the sleeve grooves on the internal annular ribs—both upstream and downstream. ***(Figure 40)***
4. Gradually seat the sleeve groove on the ribs and release the fold. Press until the seating is complete on both ribs.
5. (Replace damaged roll pins). Gently press gallery O-rings around both upstream and downstream roll pins.
6. Place former downstream cage closure over upstream side of body so that the passage in the closure tab engages the roll pin. This aligns the cage closure.
7. Press the cage closure down as far as possible ***(Figure 41)***. Check for proper alignment of passage and roll pin.
8. Install downstream cage closure. Steps 6 and 7.
9. Place washer under head of center bolt, apply anti-seize compound to threads. Push bolt with washer through upstream cage to extend through downstream cage closure.
10. Do not lubricate fairing nut O-ring. This will facilitate torquing center bolt without need of holding the nut. Insert fairing nut O-ring into groove of fairing nut.

11. Thread fairing nut onto bolt until finger tight.

12. Torque center bolt to the following torques.

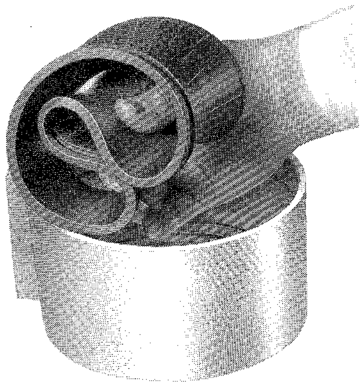


FIGURE 39

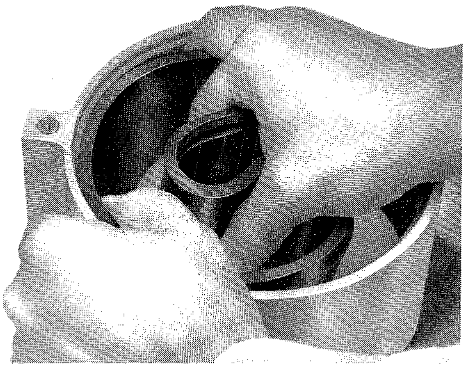


FIGURE 40

FIGURE 41

300 AND 600 SERIES	
Valve Size Inches	**Torque**
2 and 3	20 to 30 ft. lbs.
4	40 to 60 ft. lbs.
6	75 to 100 ft. lbs.
8	140 to 180 ft. lbs.
12	375 to 475 ft. lbs.

NOTE: The fairing nut is provided with flat wrench surfaces for holding the nut. This should not be necessary if the fairing nut O-ring is dry.

Do not torque the center bolt by turning the fairing nut.

13. Check the assembled valve. The cage closures must seat completely on the body and the cage closure tab must seat over the gallery.

STORAGE

The Axial Flow Valve is ruggedly constructed from corrosion resistant steel. The rubber products used in the standard valves are durable and resistant to aging. Valves can be stored in conditions commonly found in most warehouses and tool rooms. A clean, cool, dry area is ideal for storage.

New Valves - New Valves can be stored in shipping containers.

Valve Storage - Ideally, Axial Flow Valves should be stored in original shipping containers. Plastic bags may also be used and will prevent foreign material and insects from entering the valve passages. When removing an Axial Flow Valve from service, it is recommended the valve be thoroughly cleaned and inspected prior to being stored.

For Sleeve storage please see instruction sheet: "AFV Sleeves - Elastomer storage 73022664"

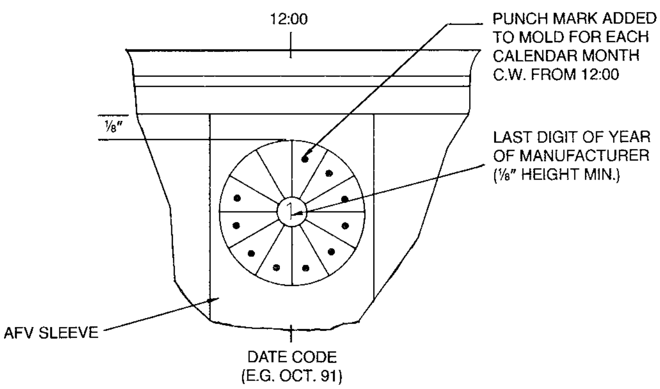
SLEEVE DATA STAMP

All Axial Flow Valve sleeves utilize a manufacturer's date stamp found below the sleeves ID code next to the color code.

Because each sleeve has a specific shelf life, the date stamp will be useful in determining the proper time to use the sleeve.

Figure 00 below illustrates the stamp showing the numeric digit in the center of the circle representing the latest manufactured year by utilizing the last digit of that specific year.

The punch marks in the outer circle represents each calendar month for the year moving clockwise from the twelve o'clock position.



AXIAL FLOW VALVE - 300 SERIES *(See Figure 42)*

ITEM NO.	DESCRIPTION	VALVE SIZE (IN.)	QTY.	PART NO.
2	**Closure,** Valve Cage, 17-4 Stainless Steel	2	2	73402P001
		3	2	73402P002
		4	2	73402P003
		6	2	73402P004
		8	2	73402P005
		12	2	73402P007
2A	**Reduced** Capacity Valve Cage	2R10	1	73402PO16
		2R25	1	73402PO15
		2R50	2	73402P008
3	**Sleeve,** Buna N—Durometer 50 Low Delta Pressure Code B5-L, Orange Stripe	2.2R	1	73404P067
		3	1	73404P068
		4	1	73404P069
		6	1	73404P070
		8	1	73404P072
	Sleeve, Buna N—Durometer 50 Code B5, Blue Stripe	2.2R	1	73404P055
		3	1	73404P057
		4	1	73404P059
		6	1	73404P061
		8	1	73404P063
		12	1	73404P065
	Sleeve, Buna N—Durometer 70 Code B7, Blue Stripe	2.2R	1	73404P056
		3	1	73404P058
		4	1	73404P060
		6	1	73404P062
		8	1	73404P064
		12	1	73404P066
	Sleeve, Hydrin 200†—Durometer 50 Low Delta Pressure Code H-5L, Orange Stripe	2.2R	1	73404P051
		3	1	73404P052
		4	1	73404P053
		6	1	73404P054
		8	1	73404P071
	Sleeve, Hydrin 200†—Durometer 50 Code H5, Blue Stripe	2.2R	1	73404P008
		3	1	73404P009
		4	1	73404P010
		6	1	73404P011
		8	1	73404P012
		12	1	73404P014
	Sleeve, Hydrin 200†—Durometer 70 Code H7, Blue Stripe	2.2R	1	73404P002
		3	1	73404P003
		4	1	73404P001
		6	1	73404P004
		8	1	73404P005
		12	1	73404P007
	Sleeve, Vito—Durometer 70 Code V7 Blue Stripe	2.2R	1	73404P015
		3	1	73404P016
		4	1	73404P017
		6	1	73404P018

†Trademark B F Goodrich Co.

ITEM NO.	DESCRIPTION	VALVE SIZE (IN.)	QTY.	PART NO.
	Sleeve, Fluorosilicone Rubber Durometer 50 Code F5, Blue Stripe	2.2R	1	73404P033
		3	1	73404P034
		4	1	73404P035
		6	1	73404P036
	Sleeve, Natural Rubber Durometer 70 Code N7, Blue Stripe	2.2R	1	73404P039
		3	1	73404P040
		4	1	73404P041
		6	1	73404P042
		8	1	73404P043
		12	1	73404P044
4	**Nut,** Fairing, Stainless Steel	2.2R	1	73401P001
		3	1	73401P001
		4	1	73401P002
		6	1	73401P003
		8	1	73401P004
		12	1	73401P005
5	**Screw,** Cap, Stainless Steel	2.2R	1	78000P090
		3	1	78000P093
		4	1	78000P087
		6	1	78000P094
		8	1	78000P095
		12	1	78000P091
6	**Washer,** Stainless Steel	2.2R	1	70176P041
		3	1	70176P041
		4	1	70176P039
		6	1	78034P013
		8	1	70176P043
		12	1	78034P012
7	**"O" Ring,** Fairing Nut, Buna N (Standard)	2.2R	1	42710P150
		3	1	42710P150
		4	1	42710P081
		6	1	42710P155
		8	1	42710P156
		12	1	42710P160
	O-Ring, Fairing Nut, Viton A	2.2R	1	78037P096
		3	1	78037P096
		4	1	78037P097
		6	1	78037P098
8	**"O" Ring,** Roll Pin, Buna A (Standard)	All	2	42710P146
	"O" Ring, Roll Pin, Viton A	All	2	78037P094
9	**Roll Pin,** ¼"D x ⅜"L Steel (Standard)	2.2R	2	78137P004
	Roll Pin, ¼"D x ⅛"L Steel (Standard)	3	2	78137F003
		4	2	78137P003
		6	2	78137P003
		8	2	78137P003
		12	2	78137P003
	Roll Pin, ¼"D x x½"L Stainless Steel	3	2	78137P005
		4	2	78137P005
		6	2	78137P005
		8	2	78137P005
		12	2	78137P005

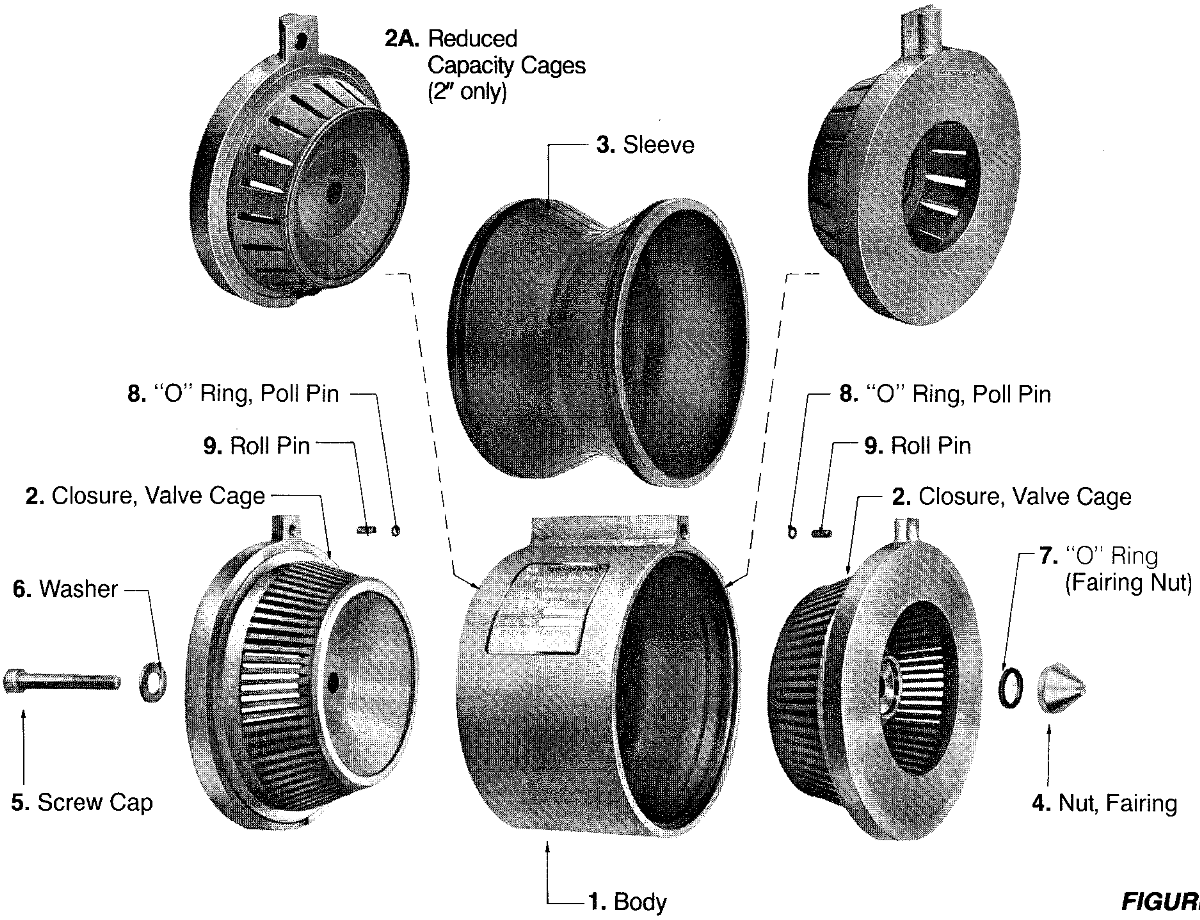


FIGURE 42

AXIAL FLOW VALVE - 600 SERIES *(See Figure 42)*

ITEM NO.	DESCRIPTION	VALVE SIZE (IN.)	QTY.	PART NO.
2	**Closure,** Valve Cage 17-4 Stainless Steel	2	2	73679P001
		4	2	73679P003
		6	2	73679P004
		8	2	73679P005
2A	**Reduced,** Capacity Valve Cage	2R10	1	73679P009
		2R25	1	73679P008
		2R50	2	73679P007
3	**Sleeve,** Buna N (Std.) Durometer 70 Code B7, Red Stripe	2,2R	1	73677P007
		4	1	73677P008
		6	1	73677P009
		8	1	73677P010
	Sleeve, Viton Durometer 70 Code V7, Red Stripe	2,2R	1	73677P011
		4	1	73677P012
		6	1	73677P013
		8	1	73677P014
	Sleeve, Hydrin Durometer 70 Code H7, Red Stripe	2,2R	1	73677P001
		4	1	73677P003
		6	1	73677P004
		8	1	73677P005

ITEM NO.	DESCRIPTION	VALVE SIZE (IN.)	QTY.	PART NO.
4	**Nut,** Fairing, Stainless Steel (Center Bolt)	2,2R	1	73401P001
		4	1	73401P002
		6	1	73401P003
		8	1	73401P004
5	**Screw,** Cap, Stainless Steel	2,2R	1	78000P090
		4	1	78000P087
		6	1	78000P094
		8	1	78000P095
6	**Washer,** Stainless Steel	2,2R	1	70176P041
		4	1	70176P039
		6	1	78034P013
		8	1	70176P043
7	**"O" Ring,** Fairing Nut , Buna N	2,2R	1	42710P150
		4	1	42710P081
		6	1	42710P155
		8	1	42710P156
8	**"O" Ring,** Roll Pin, Buna N	All	2	78037P003
9	**Roll Pin,** ¼"D x ⅜"L	2,2R	2	78137P004
	Roll Pin, ¼"D x ½"L	4	2	78137P003
		6	2	78137P003
		8	2	78137P003

AXIAL FLOW VALVE - STUD BOLTS AND NUTS

300 SERIES

Valve Size	ANSI Flange	Dia. Inches	No. Threads per inch	Length Inches	Stud Bolt Part No.†	No. Req.	Nut. Part. No.	No. Req.
2,2R	125-150	⅝	11 UNC	7	78018P029	4	78019P033	8
	250-300	⅝	11 UNC	7¼	78018P030	8	78019P033	16
3	125-150	⅝	11 UNC	8	78018P031	4	78019P033	8
	250-300	¾	10 UNC	8½	78018P032	8	78019P036	16
4	125-150	⅝	11 UNC	8¾	78018P033	8	78019P033	16
	250-300	¾	10 UNC	9¾	78018P034	8	78019P036	16
6	125-150	¾	10 UNC	10¼	78018P035	8	78019P036	16
	250-300	¾	10 UNC	11	78018P036	12	78019P036	24
8	125-150	¾	10 UNC	11½	78018P037	8	78019P036	16
	250-300	⅞	9 UNC	12¾	78018P038	12	78019P039	24
12	125-150	⅞	9 UNC	14¾	78018P041	12	78019P039	24
	250-300	1⅛	8 UNC	16¾	78018P042	16	78019P045	32

600 SERIES

Valve Size	ANSI Flange	Dia. Inches	No. Threads per inch	Length Inches	Stud Bolt Part No.†	No. Req.	Nut. Part. No.	No. Req.
2,2R	600	⅝	11 UNC	8¼	78018P050	8	78019P033	16
4	600	⅞	9 UNC	11¾	78018P052	8	78019P039	16
6	600	1	8 UNC	14¼	78018P053	12	78019P041	24
8	600	1⅛	8 UNC	16½	78018P054	12	78019P045	24

†Continuous Threads
Material-ASTM Specification A 307 Grade B -Plating Zinc per AMD T-1015

OPTIONAL ACCESSORY - 300 SERIES CENTERING TUBES

Description	Valve Size (In.)	Quantity	Part No.
Centering Tubes	2,2R	2	73552P001
	3	2	73552P002
	4	2	73552P003
	6	2	73552P004
	8	2	73552P005
	12	2	73552P007

300 and 600 SERIES ACCESSORIES

Description	Valve Size (In.)	Quantity	Part No.
Flange Separator* (300 Series Only)	2,2R, 3, 4	2	73593G001
	6, 8	2	73593G002
	12	2	73593G003
Lifting Plate**	2 thru 12	1	73672P001
1203 Pressure Adjusting Screw Retrofit Kit	2 thru 12	1	74073K001
Inspirator Control Manifold w/ Plug	2 thru 12	1	74067K001
Internal Composite Manifold Plug	2 thru 12	1	74036K001
Inspirator Control Manifold Plug		1	74036K002

***Flange Separators** - The installation and removal of the valve may be facilitated by the use of two flange separators. Flange separators are placed on each side of the valve to jack the flanges apart and thereby relieve a piping strain to facilitate valve removal and replacement.

****Lifting Plate** - Provides a ½" x 1½" aperture for engagement by hook, chain, or cable for lifting the Axial Flow Valve. The lifting plate is particularly useful for handling the 8-inch and 12-inch valve. The lifting plate attaches to the valve gallery utilizing the same two 5/16" x 2" bolts required for the manifold block.

AXIAL FLOW VALVE SIZES AND WEIGHTS

300 SERIES

Valve Size	Weight in Pounds	Widths in Inches
2-inch & 2R	5¾	3 1/32
3-inch	9	3 23/32
4-inch	19	4½
6-inch	38	5½
8-inch	80	6 23/32
12-inch	177	9 7/16

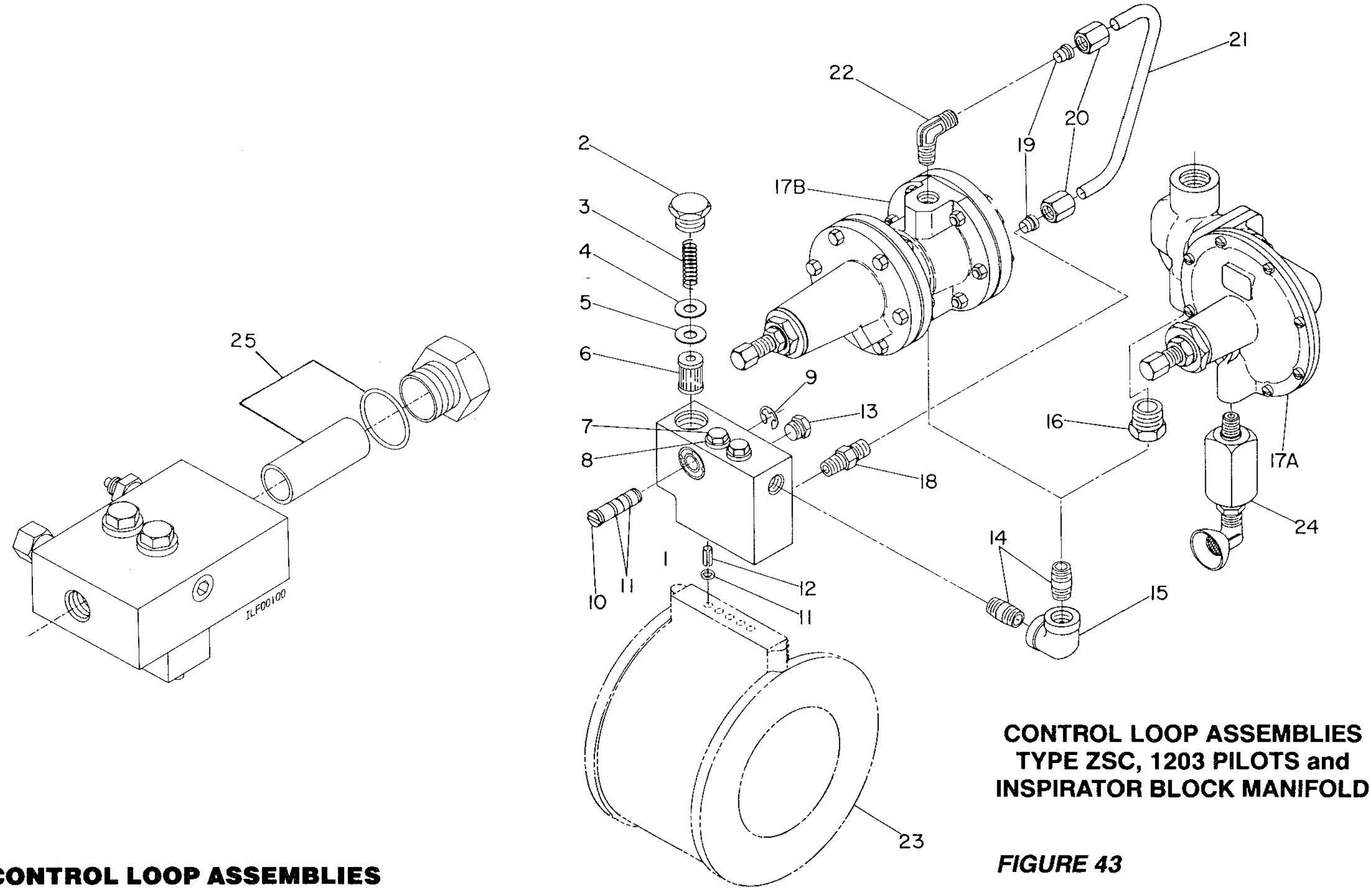
600 SERIES

Valve Size	Weight in Pounds	Widths in Inches
2-inch	7½	3 13/32
4-inch	31½	5¼
6-inch	73½	6⅞
8-inch	122	8 5/64

For additional literature and product information please refer to the following bulletins:

Bulletin No.	Title
SB 8545	Z Pilot Regulators
SB 9509	Axial Flow Valves
SB 9510	Axial Flow Valves
SB 9520	AFV Low Differential Pressures
SB 9525	AFV Accessories
TDB 9610	AFV Capacity Tables

Control Loop Repair Parts



CONTROL LOOP ASSEMBLIES
TYPE ZSC, 1203 PILOTS and
INSPIRATOR BLOCK MANIFOLD

FIGURE 43

CONTROL LOOP ASSEMBLIES

ITEM NO.	DESCRIPTION		QUANTITY PER UNIT	PART NO.
1	**Block,** Manifold - Assembly (includes items #2 thru 13)		1	73957G001
2	**Plug,** Hex Hd. W/"O" Ring		1	78479P001
3	**Spring**		1	71403P012
4	**Washer**		1	78034P016
5	**Gasket**		1	70019P106
6	**Filter Assembly**		1	78480P001
7	**Screw,** Hex Hd.		2	78000P106
8	**Washer**		2	70176P040
9	**Ring,** Retaining		1	78074P029
10	**Core,** Restrictor		1	73659P003
11	**"O" Ring**		5	78037P003
12	**Rollpin**		3	78137P003
13	**Plug,** Pipe ¼" Steel	W/17A Pilot	3	78039P003
		W/17B Pilot	2	78039P003

ITEM NO.	DESCRIPTION	QUANTITY PER UNIT	PART NO.
14	**Nipple,** Pipe - ¼"	2	78044P006
15	**Elbow**	1	78041P002
16	**Bushing,** Reducing (use with 17A only)	1	78042P002
17A	**Model 1203 - 180 - Pilot**	1	PL-105
17B	**Type ZSC Pilot**	1	PL-140
18	**Connector,** Tube	1	78109P001
19	**Sleeve**	2	78109P004
20	**Nut,** Tube Connector	2	78109P003
21	**Tubing - ⅜"**	1	72201P013
22	**Elbow**	1	78109P002
23	**Valve,** Axial Flow	1	
24	**Restrictor,** Damping	1	73688G002
25	**Filter Assembly,** Inspirator Blk. (optional)	1	74074K001

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